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THE USES OF WATER

IN MODERN MEDICINE.

BY

SIMON BARUCH, M. D.,

Attending Physician to the Manhattan General Hospital and New York Juvenile Asylum; Consulting Physician to the Montefiore Home for Chronic Invalids; formerly Chairman of the Board of Health of South Carolina; Gynæcologist to the Northeastern Dispensary, and Physician for Eye, Ear, and Throat to the Northwestern Dispensary of New York; Member of the New York Academy of Medicine, County Medical Society, and Northwestern Medical and Surgical Society of New York; Honorary Member of the South Carolina Medical Association.

VOLUME I. and II

1892.
GEORGE S. DAVIS,
DETROIT, MICH.

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TO

DR. WILHELM WINTERNITZ,

PROFESSOR OF HYDROTHERAPY IN THE VIENNA UNIVERSITY,

The Father of Modern Hydrotherapy,

THIS WORK IS DEDICATED

BY THE AUTHOR,

as a token of appreciation of the hospitality and instruction received by him at the Institute in Kaltenleutgeben.

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PREFACE.

That the proper methods of applying water in disease require to be brought before the American medical public in a comprehensive, practical form has long been the author's observation. He has, therefore, undertaken to write a succinct account of the present status of water as a therapeutic agent. The only work in the English language which has not the taint of quackery, the valuable treatise of Winternitz in Ziemssen's Handbook of Therapeutics, has long been out of print. Owing to its being a portion of a large work, it has escaped the attention of the profession, and has not received the appreciation it deserves as a scientific exposition of the views of an author who has rendered medicine the incalculable service of rescuing the remedial virtues of water from the empirical environment into which it had fallen, and to which the medical profession appeared until recently to be inclined to abandon it.

As Ziemssen has justly said, "whatever we know of hydrotherapy, we owe to Winternitz." To Prof. Winternitz I am personally indebted, not only for knowledge derived from his numerous scientific and clinical writings, each one of which is replete with logically stated truths, but also for personal guidance and instruction during a sojourn at his institution in Kaltenleutgeben, where the best informed hydrotherapists in Europe have received their instruction.

In this monograph it is not proposed to furnish an exposition of hydropathy or the water-cure system, that method of treatment whose enthusiastic followers claim that it will inaugurate the millennium of therapeutics, because

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its efficacy is not less marvelous than its methods are simple and easily comprehended. It is the author's purpose to *sever hydrotherapy from any connection with hydropathy* or water-cure, and so present the subject that the general practitioner may avail himself of the former, just as he does of the medicinal agents, of whose action he really is capable of learning much less.

The author desires to emphasize the fact, however, that, while he recognizes the undoubted value of water as a therapeutic agent, he is not prepared to substitute it for all other therapeutic agents. He would not be guided by his own clinical experience at the bedside, were he to disregard the result of clinical and physiological investigations which have given us concentrated alkaloids of positive action to replace crude drugs, and which have brought forth an entire series of new products of the mineral world—chiefly the coal tar series, whose effects upon some of our most important physiological processes border on the marvelous. Drugs which possess the power of reducing or increasing the rate of the pulse, of diminishing or enhancing its tension, of lowering at will the temperature when elevated by disease, of lulling to rest the wearied brain, of completely abolishing local or general sensation, one or both, of supplying deficient elements in gastric juices, neutralizing peccant matter in the gastro-intestinal tract, etc.—such drugs are entitled to the respectful and careful attention of the conscientious physician. Of all men the physician should be broad and liberal, and should shrink from all exclusive or universal remedies. For this reason I beg to emphasize my belief in all those drugs whose effects have been positively demonstrated in the laboratory and at the bedside, while I espouse water as perhaps the most potent of all remedial measures, upon the historical, physiological, and clinical grounds succinctly set forth in the following pages. Herein lies the distinction be-

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tween hydrotherapy and hydropathy; the former accepting water as one important remedial agent, the latter regarding it as a universal remedy. The term water-cure, too, is unfortunate, inasmuch as it implies a specific certain effect. It is translated from the German Wasser-Kur, which in German really does not convey the meaning of a *cure*, but simply a treatment, as is indicated by its Latin derivation, *cura*, "a care."

The subject will be presented in an aspect different from that in which it has been treated hitherto. Recent advances in therapeutics have developed important effects of water which are out of the limits of the lines usually drawn by authors on this subject.

It is the aim of this work to present the subject entirely from the standpoint of the clinical observer, who, standing at the bedside, weighs the claims of water in the balance, and selects from the best scientific work and from the enormous quantity of chaff in which the teaching and practice of empirics have buried the golden wheat such truths as have not only a rational theoretical basis, but have been actually verified by large clinical and hospital experience, larger, indeed, than most other therapeutic measures may boast of.

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CHAPTER I.

HISTORY.

The application of pure water in or upon any part of the human body for remedial purposes is known as Hydrotherapy. This term, therefore, includes the use of water in any form, from ice to vapor, internally or externally.

It is not an infrequent error to regard the external application of *cold* water, or its combination with cold water drinking, as in the so-called water-cure, as the only aim of hydrotherapy. The modern application of the term, on the contrary, embraces every method by which pure and unadulterated water is utilized in the treatment of disease. The surgical use of hot water for purposes of asepsis, the gynæcological application for the treatment of pelvic inflammation, its internal use in gastric derangements, the need of tepid temperature in intestinal diseases, all these belong to the field of hydrotherapeutics, because they depend upon the effect of temperature and mechanical results of water alone.

The successful application of ice (frozen water) in cardiac and inflammatory affections furnishes another illustration of the value of modern hydrotherapy. The use of vapor in rheumatic and other affections belongs to the same category. The author does not propose to confine himself to the ex-

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ternal and internal use of cold water, as is the practice of hydropaths, but to expand into a broader and more fruitful field, whose limitations shall be that water in some shape is the agent applied in the treatment.

DIVISION OF THE SUBJECT.

It is the aim of this work to present the claim of hydrotherapy to the reader's attention upon argument derived from historical, physiological, and clinical data; in other words, to treat it precisely as all other remedies are presented in an essay on Therapeutics.

HISTORY.

It is a singular fact that, while other professions and trades regard the study of the history of their subject as an important element in their education, the physician alone permits this profitable field to remain uncultivated. The history of the world, says Kant, is the forum of the world. It alone presents to us a portrayal of truth, and guards us against error.

The history of water as a therapeutic agent is not only one of the most interesting chapters, but it affords the clearest demonstration of the instability of therapeutic propositions and the manner in which prevailing ideas influence them. Although the literature of the subject is the most extensive published, with regard to any remedy, recent works on Therapeutics treat it with a decidedly stepmotherly regard;

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they dismiss it in a few beggarly lines, preferring to devote their columns to essays upon the action of remedies which have been chiefly tested on animals, and whose actual clinical value is, in most instances at least, problematical. The history of water teaches clearly that no one remedy has so creditably passed through vicissitudes of depression, and that, despite professional and lay prejudice, it stands to-day unscathed and rendered secure against assault by the panoply obtained from physiology and bedside results. The works of Hippocrates, the father of systematic medicine, illustrate how a master-mind may grasp facts and make deductions which may stand the test of time. Appearing upon the stage of action at a time when the greatest confusion had been brought into the treatment of disease by priests, philosophers, and physicians, this great genius brought order out of chaos into every branch of medicine, and endeavored to endow with true scientific dignity the empirical knowledge of the day. In his tract on the use of fluids he laid down rules for the treatment of acute and chronic diseases by water, which are to-day followed by empirics as well as physicians, and which, together with subsequent developments, place hydrotherapy among orthodox and scientific methods of treatment.

Among the Greek physicians and philosophers who, during the rise of Roman greatness, emigrated from their native land to seek fame and fortune amid

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the world-conquering people was Asclepiades, of Prusa. Leaving Alexandria and Athens one hundred years B. C., he entered Rome under Marius and Sulla. Though belonging to a despised class, he became the bosom friend of Cicero, and won for himself eminence, respect, and professional reputation because of his great medical talents, his marvelous cures, and especially on account of his genial and sympathetic nature. It was his chief aim to cure *cito, tuto, et jucunde.* Hence he cast aside all active medication. Although he practiced bleeding, he did so cautiously, and he depended chiefly on diet, rubbing, exercise, and *baths.*

It will be remarked in the history of this subject that the same men whose judicial medical thought elevated them so far beyond their contemporaries as to resist the prevalent practice of excessive venesection and active medication, exhibiting a regard for the conservative tendencies of nature—the men who, in those dark days of medical history, approached most nearly the spirit which governs the therapeusis of the present enlightened era—these were the men who were invariably pronounced advocates of water as a remedy. Asclepiades, the philosophical founder of the school from which sprang Themison, Antonius Musa, Cornelius Celsus, Cœlius Aurelianus, was so warm an advocate of baths and douches that he was dubbed "Psychrolutus." Through him hydrotherapy was popularized in Rome.

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A member of his school it was, Antonius Musa, who maintained the aim of his noble master to rescue his calling from the disrespect with which it was regarded. To him the Emperor Augustus owed restoration to health, by a vigorous cold-water treatment. Suetonius tells us that the grateful Cæsar bestowed, not alone upon Musa but upon the whole medical profession, the privileges of citizenship, besides erecting to him a statue next to Æsculapius.

Horace, too, was his patient. His first book, Epistle vi (Smart's Translation), tells us: "Antonius Musa pronounces Baieæ to be of no use to me, yet makes me obnoxious to the place, when I am bathed in cold water even in the midst of frost, by his prescription."

Cornelius Celsus, the learned Roman (called Latinorum Hippocrates, Medicorum Cicero), the bosom friend of Ovid and companion of Fabius Maximus, prescribed water freely in acute and chronic diseases. His opinions on the prevalent blood-letting mania mark him as an eclectic of the highest type. The same may be said of Cœlius Aurelianus, who was the originator of the abdominal compress of wet sponge for hypochondriacs. Galen, too, was an able and judicious advocate of cold-water baths, and advised cold affusions upon the head, while the body was immersed in warm water.

In the dark days of medicine which followed the death of Galen, when all branches of human knowl-

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edge suffered from the ignorance, witchcraft, and fraud arising from the barbarism of migratory peoples, from the destruction of the Alexandrian library and school, from the demolition of the Roman Empire, the plundering of Saracens, and the conquest of Spain, science and art lay prostrate. At this time appeared Alexander of Tralles and Paulus Ægineta. The former refused to rely upon any system of medicine, but insisted, with a true philosophical spirit which would do credit to him to-day, that the physician must depend in each single case upon the age, constitution, natural powers, and mode of life of the patient, as well as upon the climate andallied conditions and effects of nature. He furnished directions for bathing and rubbing in many diseases.

Paulus Ægineta, who is regarded as the greatest physician of the seventh and eighth centuries, was an enthusiastic advocate of water, and he it was who first advised the cold douche for sunstroke and anuria. The next prominent figure in the history of hydrotherapy is Savanarola, the grandfather of the unhappily famous professor of Ferrara. He recommended baths in fevers, dysentery, leucorrhœa, and debility. No history seems to be complete without the Chinese. Julien (Comptes Rendus, 1849) tells us that in the annals of the dynasty of Hâ, the biography of Hoa, a celebrated physician, is written. Hoa used hydrotherapy by sweating and cold water. The historian relates that in a case of rheumatism Hoa ordered one

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hundred affusions. After the seventeenth the woman thought herself dying; after the twenty-fourth reaction ensued, "the internal heat came through all her pores, rising in vapor two feet above her head. After the one hundredth she was put into a warm bed."

In the seventeenth century Herman van der Heyden regarded water as a panacea, reporting three hundred and sixty cases of malignant dysentery cured by its use. Van Helmont and his son advocated ablutions and affusions.

Passing over lesser events, we come to an epoch in hydrotherapy created by Floyer, an educated English physician, whose book, published in 1697, passed through six editions and was translated into German forty years later. He energetically propagated his views by his writings, making many converts at home and abroad.

Those who are familiar with the names of great English physicians will appreciate the value of such names as Pitcairne Blair, Cheyne, Huxham, who were advocates of water in disease. Floyer was succeeded in the advocacy of hydrotherapy by Fridrich Hoffman, the most illustrious physician of Europe at that time. He held a professorial chair, and, commanding great respect, found many followers. The first distinct recognition of the influence of water upon the tone of the tissue came from this philosophical clinical teacher. His doctrines were imported into Italy,

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and thence found their way to France and back again to England, where Floyer had prepared the way. Theden, the surgeon of Frederick the Great, was the first to use water in smallpox, malignant fever, rheumatism, and inflammation of the joints. He improved the shower bath, and warmly advised its use. In 1743 a Silesian physician, Johann Sigmund Hahn, and his son established the principles of modern hydrotherapy in Germany, applying it in acute and chronic diseases, especially in smallpox and the other exanthemata.

Hence the same country which later produced the first great empiric, Priessnitz, may be credited also with the first great hydrotherapeutist.

During the prevalence of the pest in Moscow in 1881, cold water was used very successfully.

English-speaking physicians are perhaps better acquainted with the works of Wright and Currie in the treatment of acute fever than with any other historical fact in hydrotherapy. Currie's work was translated into several foreign languages, and his practice was introduced into the Vienna hospitals by Joseph Franck. His application of water was not limited to fevers. In gout and convulsions, paralysis, tetanus, and other diseases he claims to have obtained good results. To mention Hufeland, the enthusiastic and yet judicious advocate of hydrotherapy, is to give the imprint of true medical wisdom to it, and to indicate its wide adoption among the profession. He

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offered a prize for the best treatise on the action of cold water in fevers, determined by scientific thermometrical study. Dr. Froelich, a Vienna professor, was the most successful of three competitors, all of whose essays were published in 1823 by Hufeland.

But, despite these eminent and enthusiastic advocates, hydrotherapy did not become popular until the appearance of the peasant Priessnitz. His history is so familiar that he is erroneously regarded by many as the father of the water treatment. In 1840 he had treated over 1,500 patients from all parts of the world by the methods he had invented; and when he died, twelve years later, he had amassed several millions. The impression made by this empiric marks an epoch in hydrotherapy. His success was brilliant because he was a careful observer, a good judge of human nature, and his mechanical skill enabled him to invent various technical modifications of the water treatment, many of which have been adopted by the profession and are still in use. A copious literature sprang up in all parts of the world, and many institutions were modeled after his. The Government built roads to facilitate access to his establishment; monuments and fountains were erected to his memory. Physicians from all countries, who had been attracted to the Silesian peasant's mountain home, became converts to and missionaries of his practice.

An interesting chapter in the history of hydrotherapy is furnished by an incident in 1839. Doctors

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Engel and Wertheim petitioned the French Government for permission to open a hydropathic institution. The petition was referred to the French Academy of Medicine, which appointed a committee consisting of Bouilland, Velpeau, and Roche. The last named delivered such a tirade against hydrotherapy, characterizing it as dangerous, unscientific, chimerical, and opposed to the simplest laws of physiology and pathology, that the sixty members present made an adverse report amid great applause. On this report the Minister of Instruction refused to grant permission for the erection of hydropathic establishments to Engel and Wertheim. These physicians appealed from the decision of the Academy, and requested the authorities to investigate hydrotherapy in the hospitals. This was done in the Hospital Saint Louis, under MM. Gibert and Devergie, in 1841. These made a favorable report, resulting in the withdrawal of the interdiction previously ordered. Thus has it ever been when the biased views of inexperienced opponents were met by clinical demonstrations in hydrotherapy. Bouilland, the chairman of the committee, recanted after obtaining such practical evidence.

A few years later, Scoutetten was sent to Germany by Marshal Soult to study hydropathy. He reported that, while it cannot be reckoned a universal method, it exercises an undoubted influence on the public health, and the numerous permanent cures it has wrought in intelligent persons recommend it to

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popular attention, etc. "It lies in the interest of humanity and medical science that demonstration of the forms and aids of hydropathy in Paris should take place under the eyes of able physicians." This report gave a great impetus to the development of hydrotherapy among French physicians, to whose honor it redounds to-day in the works of Lubanski, La Tour, Schedel, Fleury, Duval, Dujardin-Beaumetz, Charcot, Valleix, Delmas, Keller and others.

The great Magendie aided its propagation by physiological demonstrations. But Fleury founded almost a separate school of hydrotherapy by the introduction of douches as the chief method, fortifying his clinical results by physiological and rational deductions.

Modern fever treatment received its great initiative from Ernest Brand, who in 1861 published his remarkable results from immersion and compresses of water from 54° to 68° F. Bartels and Juergensen are names familiar to the present generation. Vienna became a great centre of hydrotherapy, which it has remained under Winternitz, its chief modern promoter, the corypheus of scientific hydrotherapy.

This rapid and imperfect review brings us down to the present day, when great clinical teachers reaffirm their faith in a method of treatment which had received the highest encomiums from Hippocrates, Asclepiades, Celsus, Hufeland, and Currie.

Niemeyer, in his book on practice, says of it in

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scrofula: "A series of cases are on record in which complete and perfect cures have been obtained by these means, after all other methods of treatment have been applied in vain."

Dujardin-Beaumetz said in his lectures at l'Hôpital Cochin in 1887: "The benefits we obtain from cold water in the cure of disease arise from its physiological effect upon the circulation, the nervous system, the nutrition, and from its revulsive and heat-lowering influence."

Prof. M. Peter, of the Paris School of Medicine, in his preface to the magnificent clinical work on hydrotherapy of Duval, published by Baillière, says: "Hydrotherapy suffices in most cases of disease; added to other treatment, it is a most powerful auxiliary. Can any one speak better or say more of it?" he asks.

In his classical contribution to V. Ziemssen's cyclopædia, Prof. Erb offers this testimony: "To the most important and most active agents in the therapeutics of our field (nervous diseases) belong cool and cold baths, viz., the application of cold water in the most varied forms; that which is usually termed 'cold water treatment.' Having been in recent times practiced more rationally and studied more exactly, it has attained remarkable prominence. *Its results in all possible forms of chronic nervous diseases are extraordinarily favorable.* If we add to this the heightened skin and muscular action induced by

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various methods of bathing, the influence of diet, etc., it becomes evident that *we possess few remedies which produce an equally powerful effect upon the nervous system.*" The italics are mine.

Semmola, Professor of Therapeutics in the Naples University, whose lectures (1890) have been translated into German and have received a laudatory preface from Prof. Nothnagel, says: "Hydrotherapy stimulates cutaneous activity, and with it all functions of tissue change and organic purification, so that often real marvels of restoration in severe and desperate cases are accomplished. Unfortunately, these remarkable results are more rare to-day than they were in the time of Priessnitz, of which I was myself a witness. The reason appears to lie in the fact that hydrotherapy has become the monopoly of the exclusively trade doctors, who treat the various maladies without strict selection of the hydriatic procedure in each case, etc. Without going here into the mechanism by which a rational and earnestly practiced hydrotherapy may lead to a rapid and truly organic renovation, provided that the apparatus of the economy is capable of responding to the increased labor thrown upon it, one thing is certain, that restoration of the organs can only be attained by physiological agencies, *i. e.*, by measures which act in accord with normal functions.

"*It is to be regretted that physicians in general do not place the estimate upon hydriatic treatment which it*

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deserves, for, with the exception of diseases of the nervous system (in which the water treatment is often used in a most senseless manner), little and bad use is made of it in diathetic affections.

"Those who were in the position to follow up the cures of Priessnitz will remember well what remarkable and unexpected curative successes were obtained at Gräfenberg by means of the cold water treatment.

"Let me impress upon you firmly this classical method of evoking and furthering a rational therapy, which powerfully contributes to rejuvenate the powers of the organism, and thus best secures therapeutic success. There are other diseases of tissue change, in which hydrotherapy offers a rational ætiological therapy. I refer to those alterations in tissue change which are exclusively the result of vicious modes of life. In all these cases, which may be united under the common term of retardation of tissue-metamorphosis, *hydrotherapy presents a truly rational treatment, and therefore certain and unfailing effects*, unless the local processes have reached incurable limits (atheroma, visceral arterio-sclerosis, etc.). In these cases, indeed, pharmacology alone is also powerless in its results."

Prof. F. A. Hoffman, of Leipsic University, in his lectures on General Therapeutics (F. C. Vogel, 1888), which were regarded by the reviewer, Prof. Ewald, as the most able exposition of the subject in recent times, says (p. 82): "Herein lies the unsur-

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passed value of cold water in therapeutics; we invigorate the nervous system, and through it the capacity for work may be enhanced in the heart itself. Experience at the bedside occasionally presents to us really surprising things. . . . What we have learned in the most varied cerebral and spinal diseases, we may apply also to other organs. Cold water is a therapeutic agent by whose correct application we may most surely and without danger of reaction exercise and invigorate the nervous system, and herein I seek its fundamental significance in the treatment of all possible internal diseases."

On page 41 he says of baths: "We shall have much to say of them, and see that they are much more important by reason of their effect upon the nutrition and activity of the inner organs, so that their direct effect upon the skin falls into the background."

On page 385 he sums up as follows: "If we review briefly the bath treatment, we find very great uniformity in its effects; almost everywhere do we see the treatment of gout, rheumatism, scrofula, chronic infarctions and exudations brought forward as indications.

"If we add old cases of syphilis, we have enumerated nearly all diseases which are treated by baths. Effects upon the heart, lungs, liver, stomach, intestines, and kidneys are rarely thought of. *I believe that a great gap exists here.*

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"We have spoken everywhere of the significance of baths for the improvement of all organs, but we also have become convinced of the great difficulty of correctly estimating their effect with precision. Nevertheless *I am convinced that in time all chronic diseases of the organs will be drawn into the domain of the bath treatment.*" The italics are mine.

The following testimony from one of the most justly eminent general practitioners in America is interesting in this connection. The University Medical Magazine (Nov., 1891) contains the following letter:

PROFESSOR H. C. WOOD:

Dear Doctor: Your paper on the Local Treatment of Dysentery should surely impel others to give it a trial. What you accomplished by the introduction of pieces of ice might, however, be obtained more pleasantly to the patient by the application of ice-water cloths over the belly, especially over the course of the lower colon, with half a pint or pint injections of cold water into the rectum. *It is amazing to me that so few physicians use cold as a remedy in inflammatory affections. Of all means of cure in such affections, wherever studied so that the remedy can be applied, there is not one to equal it.* In pleurisy, pneumonia, peritonitis, and all other "itis" it is a most efficient remedy. Moderately applied in measles, smallpox, and scarlet fever, no remedy equals it. Think of the one fact that in sixty years, with thousands of children with measles, I never lost one from that disease. In scarlet fever I never had a remedy to equal the application of cold. I scarcely ever did anything in measles, save gave a laxative, and then kept the patient

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cool—*often* sponged the whole body with cool water, and *always* gave cold drink in abundance—gave it copiously as a cooling remedy. I am not boasting—only forcing on your attention facts—regular "Gradgrind" facts. And I do it because I know that if you can be convinced of the value of the remedy, you have the manliness and the courage to advocate it. Farewell.

As ever, your friend,

HIRAM CORSON.

MAPLE HILL, August 16th, 1891.

I might multiply these opinions *ad infinitum.* But I have selected them from men who are not special hydrotherapeutists, but who are teachers of medicine in the best schools of Germany, Italy, and France—men, too, who are known everywhere as representatives of good clinical teaching.

History has repeated itself here as in other departments. The opinions of the most judicious, philosophical, and successful physicians of past ages have been sustained by the judgment of the most enlightened era. The student of the history of hydrotherapy must observe that it has passed through many cycles in the estimation of physicians. *The causes of these fluctuations* must be brought out, in order to avoid their adverse influence in the future.

With the dawn of systematic medicine came the promise of a rational appreciation of water as a remedy, which, however, was overshadowed by the tendency of its followers to build pseudo-philosophic systems rather than to enlarge the practical domain of

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therapeutics. Just as among the ancients we find the most renowned physicians the most active advocates of water as a remedy, so does its history in modern times develop the same fact. The simplicity of this remedy, however, antagonized the pedantic and self-important members of the profession; and when laymen, who must have learned its value from observing its effects in the hands of physicians, espoused it, the latter became entirely estranged. Thus did it come about that Priessnitz created a sect, the Hydropaths, whose influence for the popularization of the treatment was in inverse ratio to its adoption by the profession. And this blighting effect of the empirical espousal of water as a remedy is to-day mainly responsible for the aversion which physicians feel to its adoption. Are we just to ourselves or to those who entrust their lives and health into our keeping in maintaining this attitude? Due reflection must bring us to realize the fact that the application of water in disease is the most orthodox therapeutic measure in medicine, having (as I have shown) been fully treated by Hippocrates, and taught by those most eminent and judicious men who have made medical history. Even many of those methods which are usually regarded as inventions of Priessnitz owe their origin to physicians who lived long before his time. The abdominal wet compress, for instance, was originated by Cœlius Aurelianus.* And nearly one hundred

* Lucas; An Essay on Water. London, 1756.

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years before this Silesian peasant became famous, the Doctors Hahn, who were also Silesians, applied water in acute and chronic diseases, including smallpox, scarlatina, and measles.

The broad catholicism which characterizes modern medicine had liberated hydrotherapy from the absurd stigma of its empirical relationship. The violent methods of treatment prevalent in the first five decennia of this century were gradually usurped by more rational methods. When, in fact, a therapeutic nihilism threatened to take their place, water again came to the fore as the one substantial and promising remedial agent, in acute diseases at least. Again, Brand, Juergensen, Ziemssen, and their followers, brought the value of hydrotherapy to the attention of the profession by undoubted tests at the bedside. The battle was almost won; from all countries the echo of victory was resounding, but the erroneous idea that the sole object of the bath was the reduction of temperature proved the rock upon which this invaluable antipyretic was again to split, as it had done after the days of Hippocrates, of Hahn, Hufeland, and Currie. Antipyresis became the misleading watchword of fever treatment. Before the invention of chemical antipyretics, water was the only reliable agent for reducing temperature, against which quinine struggled in vain for rivalry. Now the busy chemist came to the fore and astonished the medical world by the discovery of true antithermic agents, whose

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influence upon temperature reduction was undoubted and marvelous in its precision. It was not long, however, ere the clinical tests discovered the inadequacy, indeed the perniciousness, of relying upon mere temperature reduction for therapeutic success. "I am an enemy to all antipyresis," said an eminent Berlin professor to me last year. "Although I was educated in the school of Traube, who was a warm advocate of bathing, I regard antipyresis as a false therapy. Away, therefore, with the bath, because it is an antipyretic." Thus has it come about that hydrotherapy in acute disease is abandoned by many, while in chronic disease it increases its hold on the profession in certain parts of the world.

To-day the best clinical teachers are making an effort to prevent water from sharing the fate of chemical antipyretics. This subject will be more fully referred to in the chapters on Fever Treatment. I must call attention, however, to a new danger which threatens hydrotherapy. The excessive medication, combined with blood-letting, which characterized medicine in the early part of this century and in the previous history, gave way to what was termed therapeutic conservatism. The writings of Bigelow and Flint in this country, and of Wunderlich and others in Europe, developed the expectant method of treatment, which aided the system in its battle against disease instead of fighting the latter at the expense of the former. A therapeutic nihilism resulting from

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the abandonment of excessive medication ensued, which endured until very recently, when certain medicinal agents, as salicylic acid, antipyrin, etc., were proved to produce definite therapeutic effects.

To-day the student is no longer tortured by the necessity of mastering needless materia medica, especially botanical details. But the other extreme has ensued; many physicians, especially in Germany, shrug their shoulders when discussing treatment, while they glow with enthusiasm when the bacteriological or pathological aspect of the case is considered.

The quack and semi-quack who haunt the flanks of the medical army, as the guerilla does that of a nation, have picked up some of these nihilistic (conservative?) ideas. The result is the formation of a sect of *natural physicians* (Naturärzte), who propagate their therapeutic ideas by lectures, books, and periodicals, and thus succeed in driving the physician from the field. Men like Father Kneippe use cold water as the chief remedy, while others more or less intelligent—teachers, preachers, and men and women of all conditions—have constructed upon hot and cold, vapor, and hot-air baths, exercise, massage, and diet, a system of Natur-heilkunde, which must very soon bring reproach upon hydrotherapy. The latter is their chief reliance; these men, being uneducated, apply it empirically, and propagate their errors among the people. There is a large institute at Chemnitz, in Saxony, devoted to the treatment of natural rem-

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edies, which I have visited, and there are many smaller ones in other parts of Germany.

It is a singular paradox that the German Government does not protect the people against these uneducated quacks. Whether they shall be allowed to pursue their calling here remains to be decided. Thus far I know only one such hydrotherapeutic institute in New York, in which the treatment is most crude and unscientific, and under the management of an ordinary masseur. Let not the profession stand idly by and allow again the value of water as a remedial means to be overshadowed by the efforts of these unskilled advocates. If *they* can obtain good therapeutic results, which I do not doubt, how much more may a correct and rational application of the remedy accomplish.

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CHAPTER II.

MODE OF ACTION OF WATER.

In the consideration of therapeutic measures it is important to define their mode of action as far as has been ascertained by trustworthy observation. So long as the art of medicine represented only the aggregate of a large mass of empirical observations, our predecessors were content with following the dicta of those to whose teaching they listened or whose writings they consulted. The dawn of the inductive method engrafted a more rational basis upon medical practice. As a result, remedies are now subjected to tests other than merely clinical, either before or after they have come into practical use.

Fortunately, we are able to distinctly trace the remedial effects of water upon physiological paths, and to make from these our therapeutic deductions.

It is proposed to show here how water may influence the most important functions of the human body in health ere the reader will be asked to accept its applications in disease.

The effect of water upon the human body is complex in accordance with the method of its applications.

INTERNAL USE OF WATER.

The internal use of water is distinct in effect from the external use, as is the case with any other therapeutic agent.

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The importance of water as a constituent of all secretions and excretions, as well as of all tissues, is so trite a physiological fact that it is referred to here only in order to emphasize the effect of changes which may be produced in these by its increased imbibition.

That water received into the stomach or rectum acts upon the *temperature* of the body has been established by numerous observers. But not only is a direct reduction of temperature produced by the imbibition of cold water. We have here also a milder effect by reflex channels which, as will be shown later, are observed when water is applied externally, as is most frequently done in practical hydrotherapy.

The reflex effect upon the vaso-motor nerves, the consequent contractions of peripheral vessels, and changes in their tension were clearly pointed out by Winternitz. As long ago as 1864 he demonstrated the effect of cold water drinking upon the pulse, by the following sphygmographic tracings:

Before drinking ⅓ quart water at 43° F.

After drinking the same.

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These tracings clearly show that immediately after drinking very cold water the ascension lines are shortened and become less perpendicular, indicating an increased tension in the radial artery.

In order to prove that the effect is entirely due to the temperature of the imbibed water, the above tracings may be compared to the following, taken before and after drinking 0.3 litres of water of about 90° F.

Before drinking ⅓ quart water at 90° F.

After drinking the same.

The change in the ascension lines is precisely reversed. That this effect is not due to the simple increase of fluid by absorption or by direct cooling or warming of the blood is demonstrated by the fact that it is observed too quickly after imbibition. It must be the result, therefore, of *reflex* action. Excitation of the vagus fibres in the stomach by cold drink is transmitted to the vaso-motor centre, from which slowing of the pulse and change in its curve is probably evolved.

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Warm fluid may produce nausea, and thus lower the innervation and result in diminished arterial tension.

The incorporation of large masses of fluid with the blood must produce decided changes in the system. Water is doubtless absorbed chiefly by means of the veins of the stomach, and its rate of absorption is governed, according to Winternitz, by various conditions. A low state of vascular tension; impoverishment of the blood by diarrhœa, hæmorrhages, profuse perspiration, and even copious urinary excretions; a feeble percentage of salts in the water; the presence of free alkali in it; all these accelerate the absorption of water from the stomach or intestines.

High vascular tension and plethoric conditions of the system, on the contrary, inhibit the absorption of water.

It follows from the physiological investigations of Böcker and others that the administration of small quantities of water at intervals of 20 to 30 minutes for a long time will increase the saturation of the tissues, render the blood column heavier, and increase vascular tension and pressure. The contrary effect may be produced, *i. e.*, absorption of watery exudations, etc., by imbibition of large quantities of fluids after long intervals of abstention (6 to 8 hours). Clinical observation has substantiated these deductions.

Tissue metamorphosis (regressive and productive).

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is enhanced. Indeed, Boecker says: "There is no single substance which so rapidly promotes construction, after inaugurating destruction, and which rejuvenates the system, like water. In the institutions where cold water is used externally and internally we see patients whose digestion has been faulty always ready for the fork exercises, and it is only necessary to drink a few glasses more water in the morning in order to do greater honor to the art of the cook. If the effect of water be compared to that of mercury, the rejuvenating effect of the former becomes clear; they both further elimination in an eminent degree; the prolonged use of mercury, however, increases elimination enormously, and constructive action suffers so much that for years a prolonged feebleness remains. Water acts differently. It interferes with constructive metamorphosis only if its use is too prolonged and combined with starvation. But as a rule, so soon as it is discontinued, reconstruction begins more energetically. That water is a remedy for the rejuvenation of the organism deserves to be therapeutically considered." This testimony from a physiologist and a clinical observer is entitled to respect, especially as it has been physiologically demonstrated by numerous other observers, among whom are Mosler, Lehman, and Glax. These have shown that the imbibition of cold water acts as a diuretic, and increases the solid constituents of the urine, especially urea. Thus it is evident that a

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more active change of nitrogenous material is inaugurated by copious water-drinking. As it has also been shown that the latter is followed by a diminution of uric and oxalic acids, and an increase of CO_2 and of oxygen, we must conclude that oxidation is more active and complete. Again, these inorganic salts of the urine, which are products of regressive metamorphosis of the organs and muscles, as potash salt, phosphates, and sulphates, are shown to be increased by drinking large quantities of water.

It is true that this interpretation of these phenomena is not accepted by all authorities, there being still some doubt whether the increase of urea after copious imbibition of water is the result of increased utilization and destruction of albumen, or simply the effect of a more thorough flushing of the vessels by which the urea is more rapidly swept out. Be this as it may, it cannot be denied that a decided increase of water imbibition gives rise to a fluctuation in the formation of urea, and thus a change is produced in the system which must produce therapeutic results. Water that is drunk is not simply excreted, but some of the tissue becomes more saturated with it, especially the glands. The latter are forced to secrete more abundantly, and the heart is called upon to propel a larger quantity of fluid; the kidneys and skin are stimulated to increased activity. And all this is accomplished in the very innermost parts of the body, far away from reflex influences, which are

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the chief agencies by which the *external* use of water acts.

Peristalsis is increased by imbibition of cold water. This may be observed readily in emaciated persons and in the expulsion of gases from the rectum.

Increased biliary secretion has also been noted by Lehman and others. Horvath has proved by passing streams of water of various temperatures (from 66° to 106° F.) that peristalsis is stimulated, and Roehrig has demonstrated by actual experiment that intestinal irrigation increases bile secretion more than the injection of water into the veins. Thus is the treatment introduced by Krull in catarrhal jaundice established upon physiological principles.

We may conclude from the results of many experiments, whose details space does not admit of recounting, that, inasmuch as an increased absorption of water into the veins must give the heart and glands more work to do, we have in the administration of large quantities of water, especially of cold water, a valuable remedy for stimulating various functions, which may be utilized clinically if the *rationale* of its action is not lost sight of.

If it is remembered that the stimulus is felt by the organs themselves, and does not depend, when the secretions are involved, so much upon reflex nerve activity, the internal use of water will be preferably applied in many cases in which its external use, which demands considerable power of reaction, would fail.

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The temperature-reducing and gland-stimulating effect of copious water imbibition has been utilized in disease recently by Meigs, Cantani, Dujardin-Beaumetz, Debove, and Sahli, as will be shown in the clinical part of this work. Suffice it here to maintain the connection between the physiological and therapeutic lines, by citing the practice of Cantani, who reduces temperature slowly but surely by copious enemata and drinking of cold water, and the practice of Beaumetz, who promotes diuresis and elimination of the products of organic disintegration by copious libations of water, and the practice of Debove, who administers, instead of drugs in typhoid fever, six ounces of cold water every two hours for the purpose of washing out the poison. In this method of hydrotherapy, as in the external method, the empirics have done much to bring its use into disrepute by the swilling to which they have subjected their patients. It must be evident to any unprejudiced observer who understands the *rationale* of water-drinking that its excessive use must overburden the system, and, if the latter be already enfeebled, must tend to cripple the organs it is intended to relieve.

EXTERNAL USE OF WATER.

This being the most important mode of application in hydrotherapy, a thorough study of its physiological effect when applied to the periphery is of great importance.

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Aside from certain minor effects, such as the antiseptic and cleansing, we may divide the essential action of water into: 1st, that evolved by its temperature effects; and, 2d, by its mechanical impact.

As a vehicle for the absorption and transmission of temperature variation to the periphery, and thence by direct or reflex action to the centres of the body, water is a phenomenally useful agent.

That it possesses an enormous capacity of absorbing heat without being itself much elevated, and of giving off heat without losing itself very materially, has been frequently demonstrated by experiments. The quantity of heat required to raise the temperature of 1 lb. of water 34° suffices to elevate to the same temperature 2 lbs. of oil of turpentine, 8 lbs. of iron, or 33 lbs. of mercury. Again, one gramme of iron at 32° may be elevated to 130° F. by the same quantity of water at 140°, while the latter only loses 43°; while one gramme of iron at 140° F. will elevate one gramme of water at 32° only to 43°, with a loss of 130°.

The enormous physical change to which water may be subjected at different temperatures enhances its value as a flexible therapeutic agent, whose effects must be carefully studied. At 32° F. water solidifies, while at 212° under ordinary atmospheric pressure it becomes elastic, attaining a volume 1,700 times greater.

When it is considered how easily the temperature of water can be varied by the judicious application of

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ice or heat, how its application may be limited to the most minute portion of the body or be made to its entire periphery, and how its local temperature effects may be varied in different parts of the body at the same time or at different times, its immense value as a therapeutic agent must be appreciated, after these effects are carefully studied, as we propose now to do.

By means of low and high temperatures we may produce positive irritation, and by means of moderate temperatures we may neutralize irritation already existing; thus we have a scale of stimulating or soothing effects, for which we look in vain among medicinal agents.

As Kroeger has aptly put it, just as the eye perceives certain waves of ethereal atoms as impressions of light, so do the organs of temperature perception, the peripheral endings of the sensory nerves, experience definite waves of body atoms as perceptions of heat and cold. This conception renders intelligible all empirically established facts which are observed in the effect of various temperatures upon the organism.

EFFECTS OF TEMPERATURES.

That temperature exercises a potent influence upon living matter is a trite physiological fact. That cold diminishes vital activity and heat enhances it needs but a simple reference to emphasize the application of these well recognized principles to thera-

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peutics. Smooth muscular fibres are positively made to contract under cold and expand under heat, within certain limits. This physiological fact alone renders it evident how powerfully we may influence heat production, which depends upon muscular activity, and consequently tissue change, which is interwoven with heat production, and indirectly by these means all other functions, by any measure which, like water, gives us complete control over muscular activity.

Although it is difficult to separate the thermic from the mechanical effect, it is useful to study each separately as far as it will admit. Cold and heat may be regarded as nerve irritants whose intensity is in proportion to the difference of temperature between the part receiving the impression and the agent conveying it.

There is, however, a limit to the therapeutic application of thermic agents. Both extremes of temperature become painful and, as is well known, may destroy sensibility and eventually vitality also.

Recent investigations by Donath (Archiv. für Psychiatrie, 1884, xv) have placed the painful cold impressions in different parts of the body of healthy persons as varying from 12° to 37° F. In different individuals the painful impression from cold varies between 29° and 73° F. Painful heat impressions also vary according to the parts applied to between 98° and 126° F.; the variations in individuals being between 36° and 88° F. The upper and lower limits

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of heat impression for various points in the skin are 147° and 95° F., respectively.

There exists great latitude in the sensibility to cold and heat impressions in different parts of the body, and even in the same parts at different times, due to the condition of the nervous system and the circulation at the time of observation.

It has been ascertained by Blix and Goldscheider that there are special terminal nerves in the skin, devoted to the perception of heat and cold and of pressure, and that the perception ot cold is rapid and lightning-like, while that of heat is more deliberate and diffused. Warming and cooling of the skin reduces the response of the latter to both heat and cold, but each enhances the response of the other to opposite temperature effects.

Thermic irritants induce changes of innervation not only at the point of contact, but also in sensory tracts, in the nerve centres, and in all motor and trophic fibres connected with them whenever they fall within the sphere of irritation, either by transmitted or reflex action. The effect upon motor fibres is not to be regarded only as reflex, for even at the point of application there are everywhere numerous networks of ganglia, which may perform the function of nerve centres within the immediate sphere without depending upon impulses from the brain or spinal cord. This makes plain many local effects, which seem to arise independently of the higher nerve centres.

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There can be no doubt that thermic irritants, conveyed by water or otherwise, exert their effect upon the innervation. The rapidity of their action alone would prove this. But clinical experience demonstrates it in the most forcible manner.

Whoever has witnessed the revivification of a fainting person by a dash of cold water, how the color returns to the pallid cheek, how the glazed eyes brighten and consciousness returns, must be convinced that only through impressions upon the sensory nerve endings, conveyed to the nerve centres, could such rapid and positive effects be initiated. That cold, though the most familiar, is not alone in this powerful influence I have demonstrated to my satisfaction.

In a case of carbolic acid poisoning, with suicidal intent, in which I had the assistance of Dr. Dillon Brown, hot water proved more efficient than cold in arousing flagging vitality.

That extreme heat and cold may destroy sensation, even to complete death of the part, is an undisputed fact. But it is not so generally known that cold applied to a nerve trunk may produce anæsthesia, and even paresis of its peripheral fibres.

Waller applied ice to the ulnar nerve in its superficial position at the elbow joint, and obtained at first hyperæsthesia, later complete anæsthesia of its branches and abolition of response in the muscles supplied by them. We are indebted to our own Weir

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Mitchell for some valuable investigations upon the subject. He demonstrated (quoted by Winternitz) that anatomical changes may be produced by intense cold applied to the nerves, such as congestion with or without sanguineous exudations. Briefly applied, cold produces a rapidly passing congestion, without leaving traces behind, but, if prolonged, the nerve increases in volume, chiefly by the dilatation of its blood-vessels. There may be actual apoplectic effusions in the structure of the nerve, producing more or less paralysis in the parts supplied by it, but they usually disappear, although some of the nerve fibres may degenerate.

Thus we may account for some cases of acute neuralgia, myelitis, and acute spinal paralysis following great temperature effects.

Upon one point all observers are agreed, viz., that the effect of the thermal impact is in proportion to its duration, viz., that an *evanescent application excites, while a prolonged one depresses.*

This is of immense importance in clinical hydrotherapy, as will be shown.

Another element of great clinical importance has been justly emphasized by Winternitz. The suddenness or deliberateness of the excitation influences the susceptibility of the part to which it is applied; the former produces tumultuous, the latter more calm results, just as in the case of the sudden and gradual application of a bright light to the eyes. Daily observation confirms the axiom, but there is a difference

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whether the transition be from warm to cold, or *vice versâ*. In the former case there is a more energetic reaction, because the nerves are in a state of heightened excitability, and this, too, is utilized in the practice of the French hydrotherapists, who precede many of their douches by hot air baths.

It must also be remembered that, as Urbantschitsch has shown, there are physiologically interchanging effects of irritation in various sensory spheres, *i.e.*, excitations in one sphere may produce similar effects in another. That the effect of temperature impressions upon the peripheral nerves may be far-reaching is thus physiologically demonstrated.

INFLUENCE OF THERMIC APPLICATIONS UPON THE CIRCULATION.

The impact of cold conveyed by any medium to the skin, as is matter of common observation, induces pallor and shriveling of the skin. Many physiologists have demonstrated that this is due to contraction of the circular fibres of the cutaneous vessels, by which the blood is driven out. In accordance with the physiological law that striated muscular fibres contract and dilate slowly, the contraction of the muscular structure of the skin is followed by a deliberate relaxation. The vessels not only resume their normal size, but even are dilated beyond it, so that more blood is received by them.

Following the process more minutely, we find

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that by intensely low temperatures the circulation in the capillaries is at first accelerated and the number of blood corpuscles diminished, when the part becomes pale.

Quickly following this acceleration there is a stasis in the capillaries, while in the smaller veins and arteries the slowing of the circulation is followed by brief and rapid oscillations, which become slower and more infrequent. Slowly the vessels become more pale, less transparent, and, finally, the movements cease, until the vessel is blocked and occluded.

When the cold is less intense and more prolonged, there ensues a retardation of the stream in the smaller capillaries, while it becomes more active in the larger vessels, which now dilate. If, however, the application is continued, the larger vessels are also contracted and blocked. A collateral hyperæmia in neighboring parts is the result, which produces more rapid circulation in them.

It is not difficult to deduce the most important physiological changes as the result of this energetic influence of cold upon the vessels, as will appear farther on.

The return of blood to the previously contracted vessels is probably not due, as is commonly supposed, to a relaxation of the coats of the vessels. When the vessels dilate after a brief application of intense cold, together with decided mechanical impact derived from pressure under which the stream of cold water

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strikes the part, the dilatation following the latter cannot be a passive process, but is more probably the result of an excitation of the inhibitory nerves, which overcomes the action of the vaso-constrictors. This is true of all vascular dilatation following the impact of cold.

REACTION.

As has been mentioned above, blanching of the surface is the immediate effect of the application of cold. This is, however, quickly followed by an active congestion, and may eventuate in stagnation of the circulation. The superficial vessels receiving direct impact dilate most quickly after the primary contraction has passed. They become distended with blood, but, since the continued application of cold renders the capillary circulation sluggish in the parts subjected to it, the veins respond less actively to the excitant influence of cold, and, their contraction being more slow, their dilatation is correspondingly slow. Thus it comes about that the blood accumulates at the point of application of the cold, which becomes turgid at first, and later cyanotic. This effect, however, but slowly reaches the deeper-seated vessels, whose contraction would, as is well known, materially influence all vessels to which they are tributary. If this happens, or if cold is applied directly to the large vessels, however, their tributaries receive a smaller supply of blood, and they accommodate themselves to the change by diminishing their calibre. The result

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is an increase of resistance, viz., tone, which can be readily demonstrated by the sphygmograph—a tone in which every part of the arterial circulation participates if the entire periphery is subjected to the cold. The condition of the pulse indicates clearly that the local hyperæmia resulting from the thermic irritants (within reasonable limits) is not an evidence of exhaustion or paralysis, but points distinctly to a heightened tension in the vascular system. It is scarcely necessary to emphasize the physiological fact that these effects are traceable to the nervous system, and that change of temperature can thus be readily induced by change in the blood supply. But it must be remembered that not alone upon the circulation may we thus energetically act, but also upon the innervation. The effect of the application of cold to the large nerve trunks is well known, and has been referred to above.

Thus it seems clearly established that the most powerful effects may be incited by the application of cold, by reason of its effect on the calibre of the vessels.

EFFECTS UPON DISTANT PARTS.

An important result of thermic applications to the periphery is obtained in their effect upon parts not directly in contact with them. Since the impulse conveyed by the heart to the blood stream continues unabated, the contraction and subsequent dilatation of the parts in immediate contact induces certain

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changes, by which vascular accommodation is accomplished.

If the blood is driven out of the narrowed vessels, it finds entrance into the collateral circulation. As a result we have collateral hyperæmia, accompanied by increased tension and rise of temperature. The vessels of those parts, again, which receive this increased blood-supply contract more vigorously, and force the blood which has, by reason of local or general pathological conditions, accumulated within them, to move on and give place to the more active current. This change in the blood-current, which has been demonstrated by actual experiment, is capable of depleting congested organs, of restoring their normal tone, and of conveying to the diseased organ material for renovating its function. Moreover, by this increase of the local circulation, *materies morbi*, elements of retrograde metamorphosis, and detritus of various kinds, whose presence has seriously menaced the activity of the suffering organ and the life of the patient, may be removed.

This brief explanation of the possibilities of hydriatic procedures and of their rationale lends color to the claim of such excellent clinicians as Semmola (Klinische Therapie, 1890, translated into German, with preface by Prof. Nothnagel) that "in visceral troubles which defy all treatment because they are favored by special alterations of tissue change, the physician may accomplish in many cases a true and

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real cure by endowing all the functions of the organism with the highest activity, by the aid of hydrotherapy." Medicinal agents are, as every experienced physician knows, utterly impotent in such cases to endow organs suffering from languid blood supply with vigor by the increased afflux of blood and heat and nerve force. This may be accomplished readily by the retrostasis which invariably results when blood is driven from one part of the body into another, not by severe local irritants, blisters, cautery, etc., but by processes which imitate the physiological closely, and which are under complete control of the hydrotherapeutist.

Like all agents that are powerful for good, however, this method may produce irreparable damage. George Johnson, of London, has shown that transient albuminuria may thus be produced, and Winternitz cites a case in which transient hæmoglobinuria was due to that cause. Vessels that have become atheromatous may be ruptured and life destroyed in the same way. Due regard must, therefore, be had in elderly people, and in those less mature also, to the condition of the vessels, ere this powerful agency of retrostasis is called into action. The experienced hydrotherapeutist endeavors to tone up threatened parts by preceding brief or enduring cold applications, and by taking care that all procedures are followed by distinct reaction to the surface.

All applications of cold to the periphery, even if

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they are followed by dilatation of the peripheral vessels in full, cause an increase of blood-pressure. The contraction of the arterial capillaries induces primarily an acceleration of the blood stream from the arteries to the veins by way of the capillaries. The return of the blood into the nervous system must be accelerated by this increased *vis a tergo*. The deepening of the respiration which also results, and which will be referred to below, increases the rapidity of the circulation of the small vessels, and induces an increased and accelerated return flow of blood into the left auricle, a slower and more vigorous systole, and more active filling of the arterial system; hence, a heightened blood pressure in it.

The sphygmograph demonstrates that the dilatation of the peripheral vessels which ensues upon reaction is not accompanied by a loss of tone and is not passive, but is probably due to an excitation of the inhibitory nerves. This is confirmed by the opposite effect which hot vapor baths produce upon sphygmographic tracings. These show plainly a reduction of tone, diminished tension, and great dicrotism.

It may be accepted as a demonstrated fact that cold enhances, while heat lowers, the tone of the vessel walls, although both are followed by vascular dilatation of the surface vessels. In the former, however, we have an accelerated and increased passage of blood, with the vessels under high tension; while in the latter we have the vessels under low ten-

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sion, and the walls relaxed and dilated, owing probably to a diminution in their elasticity. That these last must sooner or later produce a hyperæmia is evident; hence, it is important to distinguish these physiological differences between cold and warm application, which primarily do not differ materially but eventually are totally at variance.

PRACTICAL DEDUCTIONS.

The practical deduction from all the investigations on this subject is clear, that, wherever we aim to reduce blood pressure with passive hyperæmia, warm water should be applied; whenever we desire to produce increased blood pressure with active hyperæmia, without loss of that contractility which is so essential to a normal healthful circulation, we should resort to cold water. That the tension of the tissues and vessels exercises the most potent influence upon the local circulation in the blood and lymph vessels has been convincingly demonstrated by Landerer in Volkmann's Sammlung, p. 259.

If, then, we may by varying applications of heat and cold powerfully affect the tension of the tissues and vessels, it is but reasonable to deduce that by these applications we may overcome many inflammatory conditions. Clinical evidence of such effect is abundant. The increase of urinary flow, which is commonly observed after the cold bath, both in health and disease, and which I have often seen exemplified

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in typhoid fever, is another evidence of the increase of blood pressure after cold application. Not alone, however, by direct vascular effect upon the continuity of the vessels may this influence upon the circulation be produced. Formerly this was regarded as the only channel of action of remedies which produce local external hyperæmia. It was supposed that the accumulation of blood on the surface after blisters or rubefacients withdrew blood whose fluxion to internal organs was pathological, and thus proved antiphlogistic. This fallacy was exposed by the investigations of Naumann, which have become classical.

REFLEX EFFECTS.

Naumann has demonstrated clearly that the effects of peripheral irritants upon the circulation within the body were really reflex. He separated the head of a frog from the body, leaving them connected by the medulla oblongata only. He next severed one leg, after preventing loss of blood by tying the vessels so as to leave it connected with the body by the sciatic nerve. Now he applied thermal, chemical, and electric stimuli to the foot of the partially severed leg, while he observed under the microscope the mesentery of the frog. Shortly after gentle irritation of the peripheral endings of the sciatic nerve in the foot, the circulation in the vascular network of the lungs and mesentery was accelerated, and resumed the former condition slowly after the withdrawal of the irritant. A more severe

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irritation produced retardation of the flow, and even stasis occurred, as if the heart had become temporarily paralyzed. A strong irritant produced dilatation, a feeble one constriction of the vessels. The effect of these peripheral irritations upon the heart was also noted. A strong irritation of the skin weakened its circulation; a feeble irritant strengthened it. As there was no possible vascular or nerve channel from the part irritated to the part thus visibly affected, and as the cutting of the spinal cord entirely prevented this result, the conclusion is inevitable that the effect is entirely reflex. Hot water acted precisely in the same manner as other irritants. Naumann continued his investigations upon warm-blooded animals and upon man with the same result, and announced his conclusions as follows:

1. The action of epispastics is essentially produced by means of reflex action through the central organ.

2. These agents exert considerable influence upon the activity of the heart and vessels.

3. In proportion to the irritability of the individual, powerful continuous stimuli lessen the activity of the heart and vessels and weaken contraction, the vessels becoming dilated and the circulation slower.

4. Relatively weak stimulation increases the activity of the heart and vessels, strengthens cardiac contraction, narrows the vessels, and accelerates the circulation.

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5. The changes produced in the body by long-continued cutaneous stimulation last a considerable time after the conclusion of the same, as a general rule; the more enduring the stimulation applied, the longer they will last, and in a healthy person will often still be perceived after the lapse of from half to three-quarters of an hour from the conclusion of the stimulation.

6. The relaxation of the pulse which follows a more powerful cutaneous stimulation often attains its maximum during the stimulation, but frequently only after the conclusion of the same.

7. The excitant action of a relatively weak cutaneous stimulation likewise continues for a considerable time after it has been removed, but it is finally also followed by a relaxation, only that this appears much later and in a less degree than after more powerful cutaneous stimulation.

8. As a consequence of a stronger cutaneous stimulation, there constantly appears, mostly after a longer or shorter period of warming, a cooling down of the body, which often has not terminated half an hour after the cessation of the stimulus.

9. This period of alteration in temperature is of varying duration; cooling ofttimes takes place during the stimulation, but, as a rule, only after its conclusion.

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EXPERIMENTAL DEMONSTRATION BY VIVISECTION.

Prof. Max Schüller's experiments also may be cited as demonstrating with precision the influence of thermic applications to the periphery upon the circulation of the interior of the body. These experiments are of great importance, since they were made altogether with water. Schüller trephined rabbits, carefully exposing to view the vessels of the pia mater, without disturbing the dura, whose transparency facilitates such observation. He carefully noted the normal circulation of these vessels, and ascertained that even simple pressure upon the belly produced dilatation of the veins, and sometimes also of the arteries, probably through mechanical interruption of the venous return flow. When he applied pieces of ice upon the dura mater, he observed very energetic contraction of the veins and arteries, which continued half a minute even after removal of the ice. When he had removed the superior ganglion of the sympathetic, the ice had no effect upon the vessels. The most interesting observation, however, was that, when he placed cold wet compresses upon the belly of the rabbit, the vessels of the pia mater invariably dilated, cerebral pulsation became more pronounced and slower, and respiration was deepened and slowed. These phenomena continued a short time after removal of the compresses, and they were followed by transient narrowing and a return to the normal calibre. When warm compresses were applied, the arteries and veins

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of the pia mater contracted, the pulsations became less pronounced and more frequent, and respiration more shallow and rapid.

By changing the temperature of the compresses these changes were more or less rapidly produced. A very hot compress produced the same effect as a cold compress. The manifestations were also observed, but with more pronounced effect, after immersion of the entire body into cold or hot water; then the effect was exactly in the proportion to the extent of surface immersed. After prolonged immersion in cold water a narrowing of the vessels and sinking of the brain substance ensued, due, doubtless, to the reduction of temperature in the circulating blood, which approximated in effect to that produced by local ice application. The vessels of the ear also participated in the reflex effect. Immersion in warm water produced a transient dilatation, which was followed by a vigorous narrowing of the vessels and sinking of the brain substance. The cerebral movements became at first accelerated, afterward slower and more shallow, finally becoming more rapid, when the temperature was elevated.

Immersion into very hot baths produced effects similar to hot compresses, but of greater intensity and duration. Under the cold and warm douche the cerebral circulation did not vary greatly. Cold rectal enæmata always produced a moderate dilatation of the cerebral vessels. Schüller has placed hydro-

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therapy under lasting obligations by the pains taken in his observations. Winternitz and others have confirmed on the human subject the findings of Schüller in the rabbit. By means of the pletysmograph Winternitz was enabled to measure the volume of various parts, chiefly the arms, of individuals who were subjected to cold applications in a sitz bath. He ascertained that the cold affusion produced excitation of the peripheral nerve terminals, which in turn acts by reflex upon the vaso-motors. Contraction of the vessels in the vicinity of the application ensues; the blood is driven from them, thus providing other vascular areas with more blood, which increases their volume. A warm sitz bath produced the opposite effect.

PRACTICAL DEDUCTIONS.

These valuable deductions enable us to reason upon the various and somewhat paradoxical effects of cold and hot applications Upon the heart, as the chief agent in the circulation, thermic applications act more powerfully, not only, as Naumann has observed, by reflex action, but also, as Winternitz, Delmas, and others have so often demonstrated, by narrowing or dilating the peripheral arteries, and thus increasing or diminishing the vigor of the cardiac contraction by increasing or diminishing the resistance to it at the periphery.

The first impression of cold upon the sensory peripheral nerve endings is rapidly conveyed to the

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nerve centre, whose response is manifested by the induction of more rapid contraction, which is followed by an increase of vascular tension. Immediately following acceleration of the cardiac action we observe diminution of the pulse rate, even below that existing prior to the application, but the heightened tension remains. The duration of this effect depends, however, upon whether the individuals subjected to the application remain quiet or not. If absolute rest follows it, the heart's action slowly becomes less rapid; if muscular exercise follows it, the pulse sinks at first, and afterwards becomes accelerated, but does not lose its tension. If muscular exercise quickly follows the application of cold, the effect upon the circulation will be more manifest.

Even the empirical hydropaths have long insisted upon the value of sending the patients out in the open air, and in Professor Winternitz's institute, at Kaltenleutgeben, it is a rule to give most of the treatment immediately after rising, when the reactive capacity of the patients is at its height, and sending them out to walk or ride before breakfast is permitted. Thus physiological experiment confirms empirical results, and enables us to adapt our procedures to each individual case in a manner far excelling that of drug treatment. It is a well ascertained law in physiology that the functional activity of an organ is always accompanied by an increased flow of blood through it. The quantity of blood circulating in the organ being

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increased, a proportionate diminution must take place in other parts and organs, diminishing their functional activity for the time being.

Although much additional proof could be furnished, we have dwelt upon the manner in which the influence of thermic application is exercised upon the circulation with sufficient detail to convince the reader that a rational basis exists for it.

INFLUENCE OF THERMIC APPLICATIONS UPON THE RESPIRATION.

Having shown clearly how thermic applications may influence the nervous system and the circulation, it is not difficult to demonstrate the effect produced by them upon the respiration. This function depends so entirely and completely upon impulses received from the central nervous system, that any decided impression made upon the latter must affect the former. Common observation quite accords with this proposition. The deepened respiration indicated by cold affusion, or even by a simple dash of cold water into the face or upon any other sensitive part, is a patent illustration of how energetically this influence may be exerted, even when the reflexes are dormant, as in a fainting person. In the cold bath, administered for typhoid fever, there is so deep an inspiratory effort that the respiratory muscles are unable at the first moment to respond to the stimulus. The patient gasps for breath and becomes frightened, and the same

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thing occurs in health when the water is too cold. This spasmodic effort soon passes away, the muscles make more rapid effort, and then settle down to slower action. When reaction ensues the respiration is found to be deepened, but approximating the normal rhythm.

Warm applications, on the contrary, increase the number of respirations. The warm bath renders them more shallow and frequent. In the hot air boxes at the Montefiore Home the respirations are increased from 20 to 30 per cent., and sometimes become so shallow that the patient is panting.

INFLUENCE OF THERMIC APPLICATIONS UPON TISSUE CHANGE.

Carl Voit, Finkler, Duke Carl Theodore, Liebermeister, and others have demonstrated by actual experiment that in the only reliable test, the excretion of CO_2 and absorption of oxygen, oxidation is certainly enhanced by cold, and diminished by warmth, so long as the temperature is approximately constant. The sinking of temperature even slightly below the normal is at once followed by retardation of the processes of combustion, and a similar rise of temperatur produces the reverse effect. The seemingly paradoxical effects of thermic applications are thus explained: Cold may exercise the same influence upon tissue change as warmth, *according to the degree* of temperature applied. An increase of tissue change

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under cold, as Pflüger and others have shown, occurs as the result of the excitation of the sensory nerves by it, the degree of tissue change accelerated depending upon the degree of muscular contraction by it as a reflex effect. This is very important, and may be regarded as axiomatic.

The increased metabolism, resulting as a reflex effect from the influence of cold, is chiefly manifested in non-nitrogenous material; there is no increased consumption of albumen. The tissue metamorphosis following the direct influence of cold, on the contrary, is similar to that produced by raising the body temperature, either artificially or in fever. Heat abstraction, as produced by hydriatic procedures, induces an increase of nitrogenous tissue change in the course of the temperature elevation incidental to the period of reaction. These may be graded according to the grade of reaction, which is often dependent upon the heat abstraction producing it.

All experiments have demonstrated again and again that an increase of urine and diminution of its specific gravity result from cold baths. This would only indicate a more complete excretion of the products of retrograde metamorphosis of nitrogenous matters, not an increased formation. The increased elimination of urine is probably chargeable to the change of the circulation and perspiration. This is not the case in the changes produced in the urine by the *elevation* of temperature incidental to the period

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of reaction following applications of cold. Juergensen and others have shown in their studies of body heat that in six to eight hours after a cold bath the urine presents a higher specific gravity and contains more urea than it does immediately after the application.

These investigations lend a certain amount of probability to the assertion that low temperatures acting upon the body produce an increase of oxygen absorption and CO_2 excretion. If the bodily temperature is reduced by the application of cold, oxygen absorption is diminished, as well as carbonic oxide excretion. While warmth also diminishes the elevation of bodily temperature, external heat increases the respiratory function, as I have shown above, from experiments in the Montefiore Home. With this an increased excretion of nitrogen ensues.

PRACTICAL DEDUCTIONS.

Winternitz justly cites, as an evidence of the influence of the hydriatic procedures upon tissue change, the fact that among 2,400 patients treated at his institute, 56 per cent. gained in flesh, 30 per cent. lost weight, and 14 per cent. remained unchanged.

This is especially demonstrable in the improvement of the appetite and increase of flesh in cases previously very much depreciated by loss of blood owing to diseased condition of digestive organs, in phthisis and carcinoma even, and in many persons

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whose age (over fifty) would render the weight somewhat stable. Those hydriatic procedures which stimulate diaphoresis are especially calculated to aid tissue metamorphosis and changes in the blood. Profuse perspiration involves losses of water and salts. Inasmuch as there is a constant effort of the system to maintain the integrity and constancy of the blood, the removal of these salts by any means involves a compensatory effort on the part of the tissues and organs, which must impress certain changes upon them.

From these briefly stated experimental deductions and facts it would seem that more or less intense impressions are made upon tissue metamorphosis by different degrees of cold and heat, that the latter may be adapted with more or less precision to the effect aimed at. How these changes may be made more to the benefit of the patient will be shown in the clinical portion of the work. Suffice it to state here that even the composition of the blood has definitely changed by various hydriatic procedures. These changes are not only evidenced by the improved ruddiness of the previously anæmic patient, but they have been determined by the hæmometer of Fleishl and Hayem.

INFLUENCE OF THERMIC APPLICATIONS UPON THE BODY TEMPERATURE.

Without entering upon the physiology of heat-production and elimination, many of whose points are

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still *sub judice*, we propose to show clearly how the temperature of the human body may most surely be modified by thermic influence from without. This must suffice for our purposes, inasmuch as it is the aim of this work to demonstrate only by accepted facts the potent influence of hydriatic measures, which are but the conveyors of thermic impressions upon the human economy.

One physiological fact stands undisputed above all others, viz., that the temperature of a living part or organ depends upon the amount of arterial blood circulating within its tissue. The fact that venous blood returning from an organ in a high state of functional activity is warmer than the arterial blood passing into it, is alone sufficient evidence of the proposition that the arterial circulation is an important element in the equalization of the body temperature, aside from heat production. Add the physiological fact that all tissue change, all organic action, depends upon vascular activity, by means of which excretory and secretory elements are carried to and from it, and that the accumulated heat in the organs is equalized by the great streams of blood which constantly pass through them, and we have a combination of elements which almost controls temperature variations.

We have shown in a preceding chapter how hydriatic procedures influence the circulation. It remains now to demonstrate how, by utilizing this powerful influence, we may reduce or elevate the temper-

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ature in the human economy. That the application of baths of various kinds is potent in this direction, has been recognized since the primitive days of medical investigation. Indeed, the idea that the reduction of temperature is the chief, if not the sole, attribute of the baths has so strongly rooted itself in the professional mind that it is difficult to dislodge it to-day, when we have come to realize that this is only one of its valuable manifestations.

There is no evidence to prove that the influence exerted by external thermal agents is traceable to the heat-producing centres. There is abundant evidence, however, to prove that this influence is directly exerted upon that most important heat-regulating element, the peripheral cutaneous circulation. The mode of action in this direction is twofold. It is a well known fact in physical science that two bodies of different temperatures, by coming in contact, will at once make an effort to equalize their respective temperatures. This law applies to inanimate bodies, however, and is only applicable to the living body up to a certain point, because the latter is endowed with compensatory powers which enable it to resist dangerous encroachments from external temperature agencies.

COMPENSATORY ACTION.

The utilization of these very compensatory powers enables us, as will be shown, to influence the temperature of the body powerfully in health and disease—more powerfully in the latter than in the former.

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The temperature of any portion of the body surface may be reduced or elevated by its contact with media of different temperatures, until death of the part by freezing or scalding occurs. But so soon as this occurs, the inner parts are protected against further destructive invasion by the intervention of the dead part. On the other hand, temperature whose effect falls short of destroying the parts in contact with it cannot be conveyed to the deeper parts to any extent, because the collateral circulation is enhanced in the muscular structure, endowing the parts invaded with more vitality; because the muscular tissue is a bad conductor; and because the tonic contractions of the muscle which ensue upon the application of cold, for instance, create more heat. Thus the external parts are well defended against the invasion of thermic agencies by direct action, and *our means of reducing or elevating the temperature of the body by this means are very meagre.*

FALLACIES EXPOSED.

The sooner this important point is thoroughly mastered by the profession, the better. For the fallacious idea that cold baths, for instance, reduce temperature by the direct effect of the cold is still so firmly fixed in the minds of many that it is regarded as axiomatic. *The fact is that the colder the bath the less intense its power of reducing internal temperature.* The mouth temperature being so commonly accepted

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as correct is the cause of this fact not being appreciated. I have often seen the mouth temperature, after a bath of 65°, in typhoid fever, reduced to normal, when the rectal temperature was two degrees higher, although both were carefully taken for five minutes, or even longer in the mouth.

This point has never been published, but, being a clinical fact, I must insist upon it here, as I shall elsewhere also, in order that the unreasoning prejudice against the cold bath, which has its origin in the idea that its antithermic effect is in proportion to the low temperature of the bath, may be removed. The fact is, as shown by Liebermeister (Handbuch der Pathologie und Therapie des Fiebers, page 102), that, during the action of extraordinary heat abstraction from the external surface, if its intensity does not exceed certain limits, the inner temperature of the body does not fall, but even rises a little.

The second and most important temperature effect of thermic agencies, externally applied, lies in the immense power the latter gives over the cutaneous circulation. We know from the investigations of several physiologists that, when a portion of the skin is moderately heated, the temperature of neighboring portions is cooled, and that, when cutaneous surfaces are moderately cooled, the neighboring structures present a proportionally higher temperature. This effect is traceable to the collateral anæmia produced by withdrawal of blood to the surface to which warmth

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is applied, and by the driving of blood from the surface to the inner structure when cold is applied.

REACTION AIMED AT.

Reaction follows both of these conditions, either restoring the equilibrium or disturbing it in an opposite direction. Fleury, who has done so much in France toward explaining hydriatic procedures upon physiological principles, offers the following results deduced from careful experiment: Dipping the body into moderately cool water (48° to 58° F.) for thirty minutes reduced the temperature of the surface, while the inner temperature did not change at all. The more brief the application, the colder it was made, and the higher the surrounding temperature, the more rapid and complete is the reaction. The reaction entailing the re-establishment, and even the increase, of the previous temperature depends upon the conduct of the patient after the applications, it being more rapid and complete under active and passive exercise of the parts, especially a warmer surrounding medium.

Another important deduction made by Fleury is the fact that reaction depends upon the individuality of the patient and conditions of the circulation and innervation at the time. These simple facts have again and again been verified by numerous authentic authorities, and may, if properly grasped, lead to a correct understanding of many seeming paradoxes in hydrotherapy.

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WINTERNITZ'S LAW.

They confirm the law long ago enunciated by Winternitz, that the amount of temperature reduction depends more upon the intensity of the thermic irritation of the cutaneous sensory nerves than upon any other element.

The commonly observed fact that a drunken man may have his toes frost-bitten, while one in a less depressed condition of the nervous system may present a ruddy, healthful glow from the same exposure, is but an illustration of the last of Fleury's laws.

PRACTICAL DEDUCTIONS.

In typhoid and other infectious fevers it is important to bear this law in mind, for the same bath which may stimulate and refresh a patient in the first week may in the third, when his nervous system is depreciated by disease, prove a fatal depressant. For the same reason patients treated from the beginning with cold baths have their nervous systems and all functions depending on them so perfectly sustained that they can bear baths later in the disease which in neglected cases it would be homicidal to apply. Disregard of these patent facts is the reason why hydrotherapy has failed so frequently in the hands of otherwise well-informed men. It requires special study, to further which this work is written; but it is so plain that by grasping its well known principles it may be made quite clear.

The chief elements, then, in the influence we

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may exercise upon heat regulation is derived, so far as we can determine it positively, from our power to regulate the temperature of the surface of the body. This is accomplished by the change in the general circulation which, as referred to above, follows thermic applications to the periphery.

If, during the abstraction of heat from the surface, friction is resorted to, the effect upon tempera- reduction is more intense. This will be exemplified further in the "Rationale of the Cold Bath in Fever."

SUMMARY.

Winternitz sums up the automatically acting agencies which protect the body against serious heat abstraction, aside from the simultaneous changes in heat production, as follows: "Sinking of the body temperature by the physical law of contact; elevation of temperature in the muscular structure envoloping the entire body; the constancy of temperature of the inner organs as induced by the reactions which are signs of a changed blood flow and heat distribution, and the acceleration of the circulation, which may be accepted as a manifestation of rising temperature. The automatically acting protective agencies against injurious rise of body temperature are, aside from the change in heat production: Increase of heat from both the skin and lungs due to the enlarged blood stream flowing through them; increase of cutaneous secretion, due to reflex excitation, made

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possible by increased flow of blood through the skin; and change in the distribution of the blood. The importance of all these processes for the maintenance of a constant temperatnre is *a priori* obvious. Whenever an energetic contraction of the muscles and vessels of the skin drives this blood within, the giving off of heat from the surface must be diminished. There is less blood circulating in the skin, the circulation being the chief medium of heat equalization between the exterior and interior of the body. There is less heat given off at the periphery, and less blood cooled off there. The loss of heat is diminished in proportion to the diminution of the difference of temperature between the surface of the body and the medium in contact with it and the diminished area of the warmth-giving blood stream. The cooling of the body takes place, aside from the loss of heat in respiration, ingesta, and excreta, only in proportion to the direct heat conduction through the single tissue layers, each of which presents a different resistance to conduction. Hence, by contraction of the muscular vessels of the skin and the forcing out of better conducting fluid from the cutaneous and subcutaneous tissues, the heat loss from the periphery is diminished and the heat conduction through the tissues impeded. Cooling (almost to complete stoppage of the circulation) is diminished somewhat in the manner in which it may be done in a cooling-coil apparatus when the stream is interrupted in it."

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Opposite conditions ensue in case the skin is irritated by heat, when its vessels dilate and more blood is forced through it. The surface temperature is raised, the difference between it and the surrounding medium is enlarged, and the heat dissipation is increased. It is to the credit of Winternitz to have first demonstrated by actual mathematical calculations the correctness of these propositions. His assistant, Pospischl, has, by actual demonstration in fifty observations, established the following propositions:

1. Driving of the blood from and stoppage of the circulation in a part diminishes the loss of heat up to 70.6 per cent.

2. The interruption of the circulation by the production of passive hyperæmia diminishes loss of heat up to 46.2 per cent.

3. Mechanical irritants may produce an increase of heat loss up to 95 per cent.

4. Weaker chemical irritants produce an increase of heat loss to 40 per cent.; intense irritants, on the contrary, only to 8 per cent.

5. Thermic influences which produce cutis anserina diminish heat loss up to 44.5 per cent.

6. A warm rain-bath may by this means induce a reduction of heat loss up to 38.7 per cent.

7. Partial cold, wet rubbing may increase heat loss up to 80 per cent.

8. Cold rain-baths, with subsequent rest, produce,

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after a transitory diminution of temperature, an increase of 23 per cent.

9. Cold rain-baths, with subsequent exercise, increase heat loss up to 66.6 per cent.

10. Warm rain-baths, with cold fanning and subsequent rest, increase heat loss 16 per cent.

11. In two cases of fever the heat loss during the rising of the temperature was diminished 25.4 per cent.

If we accept as the result of these exact investigations the deduction that the heat dissipation may be decreased 70 per cent., or increased 90 per cent., thus enabling us to induce compensatory fluctuations that may be three times the normal, we have a ready explanation why these compensatory agencies serve to maintain the constancy of the body heat. We must also accept the deduction that in this manner may be explained the rise of temperature in fevers and its reduction by hydriatic procedures, as will be shown further on.

VALUABLE AID OF MECHANICAL ACTION UPON THE SKIN DURING BATH.

The utilization of this flexible cutaneous agency for heat maintenance enables us in disease powerfully to influence temperature. To Winternitz belongs the credit of having first demonstrated how active mechanical action on the skin, combined with the application of cold water, enhances the temperature-re-

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ducing effect. He has shown that by friction, or other active stimulation of the surface circulation during the bath, as by the wet sheet, half bath, etc., the cutaneous vessels may be made to dilate quickly and in tonic action, so that a larger area for cooling off the blood which circulates in near proximity to the cooling medium, the water, is created. The cooler blood, passing inward, is exchanged for hot blood coming from within. A simple, yet effective method of reducing the temperature is now created, which explains many inconsistencies. It is now clear that the amount of compensatory heat increase is not dependent upon the absolute amount of heat abstraction, but upon the intensity of the thermic nerve irritation, and the degree of actual cooling of the peripheral terminal nerve fibres, which govern by reflex action the increase of heat production. This will also explain why two baths of the same temperature and duration may produce quite different effects in the same individual, if in the one case he lies quiet and undisturbed, and in the other he is subjected to active friction of the periphery. In the first instance the peripheral circulation is impeded, the surface is cooled down almost to the temperature of the surrounding water, the heat production in the muscular layers is greatly enhanced, and the rectal temperature not much diminished; in the other, peripheral circulation is stimulated, the cutaneous surface is cooled down less, but the blood coming to its related vessels

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is cooled more, the heat production in the muscles is diminished, especially as tremor is prevented, and, therefore, the rectum temperature is lowered.

Winternitz is convinced of the correctness of this view, which he has long advocated and defended against influential opposition, inasmuch as recent experiments by others have verified it. The exact investigations of Speck on the influence of cooling upon the respiratory process (D. Archiv. für Klin. Med., xxxiii) demonstrate that heat abstraction from the surface of the body produces an increase of CO_2 exhalation and oxygen imbibition only when voluntary or involuntary muscular action is not avoided. Loewy (quoted by Winternitz) has shown from exact observations, in Zunz laboratory, upon the influence of cooling upon the exchange of gases in the human body (Pflüger Archiv., xlvi), that the actually positive fact in the regulation of the body temperature in man is that the first result of cold as an irritant induces contraction of the skin and its vessels, which produces an impediment to heat-dissipation. The latter is compensated completely in mild heat-abstraction, but less completely when the latter is more intense. After the latter the temperature will sink more or less; in the former it will remain constant.

Changes in heat-production may be added to by tonic or clonic muscular contraction, either voluntary or involuntary, which may occur after cold or after other irritants. Their importance as heat-regulating

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elements stands in man far below that of the skin; they cannot prevent a fall of temperature. Hence it may be regarded as a law that the regulation of the body temperature depends chiefly upon the changes in heat-dissipation, therefore chiefly upon the condition of the peripheral nerves and vessels. Inasmuch as we may influence the latter energetically by hydriatic procedures, as we have shown above, we possess a powerful agent for affecting the temperature of the body in health and disease. Winternitz points with justifiable pride to this confirmation, by the most recent investigations, of the view he has long promulgated, and he concludes his magnificent chapter on this subject as follows:

"If you connect the above with what happens in thermic and mechanical procedures, with regard to the blood and heat distribution, the control of heat dissipation—or rather, as I may say now, the control of the degree of heat production—you will find it quite natural that hydrotherapy is the most sovereign remedy, not only in the first stages of febrile diseases, not only in fevers depending upon heat retention, but in all fever processes especially, because no other remedy, if properly applied, is capable of meeting the chief therapeutic indications of the latter."

That we are fully in accord with Winternitz on this point we shall endeaver to demonstrate in the chapter on the hydriatic treatment of fevers.

We have now, as briefly as the importance of the

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subject would admit, dilated upon the rationale of the action of water, as a vehicle of thermic agencies, upon those functions of the body upon which its integrity depends in health and disease. An agent of such power must be capable of utilization in therapeutics as no other known agent can be shown to be.

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CHAPTER III.

TECHNIQUE AND CLINICAL APPLICATION OF HYDROTHERAPY.

Much of the prejudice existing against hydrotherapy is due to the more or less complex methods adopted and insisted upon by certain advocates of this treatment. It is the aim of this work to simplify hydriatic procedures by modifications which the author has found of value in his general practice (private and hospital), and to divest it of mysticism and empiricism.

NECESSITY OF PRECISION.

The first element of success in all hydriatic procedures is precision in executing them, with regard to method, duration, temperature, etc. The absolute necessity of an exact technique in the application of water as a remedial measure is unfortunately not appreciated by the profession, and its neglect is undoubtedly a cause of the failures which have operated in preventing the more general adoption of hydrotherapeutics by the practitioner. Water is so simple, so readily obtainable, and so easily applied that it would seem an unnecessary refinement of therapeutics to enlarge upon the methods of its application. On the other hand, too, the empirical hydropaths and water-cure doctors have divided and subdivided their

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procedures into numerous baths and douches, etc., each one infallibly adapted to certain conditions. It shall be our aim to steer between the Scylla of indifference and the Charybdis of over-activity, to simplify these methods, and to instruct the general practitioner in such hydriatic procedures as his common sense will enable him to apply under the guidance of physiological and pathological principles.

The first step in this direction is the appreciation of the fact that, while there is no sleight-of-hand or mystery in the hydrotherapeutic methods, there does exist a necessity for *absolute precision* in the application of water, simple and universally applicable though it be. A few illustrations from our clinical experience will impress this lesson more forcibly than the simple statement.

ILLUSTRATIONS.

Some time ago one of the house physicians of one of our metropolitan hospitals informed the writer that the cold bath treatment of typhoid fever had been inaugurated in his institution. Inquiry regarding the method adopted elicited the fact that the patient was wrapped in a wet sheet, and ice water was poured from a carriage sponge over the entire surface of the sheet, until the temperature was decidedly reduced and a reduction of 5° had been noted. The prognosis made by the writer, that the woman would die under this unphysiological management,

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was verified in two days. Failure in this case is attributable to the fact that refrigeration was the chief aim of the treatment. The success of the hydriatic management of typhoid fever rests, as will be shown, upon the principle that the refreshing influence of cold water upon innervation is the important indication. The latter is fulfilled by promoting reaction during the bath by friction of the entire body. This point has been fully elucidated in the section on the Rationale of the Action of Water. That the necessity for precision is well understood, however, by some of our metropolitan hospital physicians was made evident to the writer by the receipt of a written request from Dr. Austin Flint, one of the attendants at Bellevue Hospital, to aid him in instructing his house staff of two divisions, which will doubtless ere long bear fruit in the saving of life and in comfort.

Another illustration may be of service. The writer had occasion to suggest intestinal irrigation in two cases of summer diarrhœa of infants. Finding the treatment painful and inefficient in these cases, inquiry elicited the fact that in one case the attendant (who is an accomplished physician) had cut off the lower third of a Nélaton catheter, and converted the upper into a drainage tube by cutting three eye-holes into it. Is it surprising that the introduction of such a tube was painful and irrigation through it ineffective? One thorough irrigation in accordance with the technique laid down under this heading

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changed the entire aspect of the case. In the other case referred to, the attendant had used a No. 4 French rubber catheter, had placed the child in the dorsal position, and attempted to irrigate with a Davidson syringe. The tube doubled up in the rectum, its upper end was too small to connect with the syringe point, and failure was the inevitable result of this neglect of proper technique. The reverse of this picture is contained in the following extract from a letter received by the writer. Dr. Chas. Schram, New York City, says:

"I have successfully managed a desperate case of summer diarrhœa in a child, 18 months old, by following out implicitly the principles of treatment laid down by you in your monograph on the subject published a year ago (Medical News, July 7th, 1888). The case was one of a severe type, with high fever, muco-purulent and bloody dejections, and vomiting. I feel that I owe you a debt of gratitude for the assistance derived from studying and following the principles laid down in your paper."

A few days ago a masseur applied to the writer for work, stating that he was quite familiar with hydriatic procedures. Being asked to describe the dripping sheet process, he said that a sheet should be dipped into cold water and thrown over the patient, who should rub himself with it as well as he could, with the aid of the attendant. This specialist had entirely lost sight of the important elements of the technique,

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which are the use of a linen sheet, a thermometer for exactly estimating the temperature, and the necessity for the patient remaining entirely passive while the attendant applies the friction outside of the sheet. Recently a letter from one of the most justly eminent neurologists of America was shown to the writer, in which the following directions were given: "Wrap yourself in a cold wet sheet every night, and have some one to rub you down." This would be equivalent to saying to a patient: "Take some quinine once a day." Precision in the temperature of water (which, if cold, may vary from 35 to 80°) is as important as is dosage of medicinal agents.

The technique of hydrotherapy may be studied under (1) Procedures having for their object distinctly local effects; (2) Procedures having for their object general effects.

PROCEDURES FOR LOCAL EFFECTS.

The *mechanical* influence of water as a remedial measure is well illustrated in its simplest form when administered as lukewarm water for the purpose of acting as an emetic in gastric disturbances or as an enema in constipation. Here we have the simple mechanical effect acting by over-distension. For the former purpose the object may be accomplished best by abundant quantities of water at a temperature of about 90° F. A higher or lower temperature would probably fail. As an enema, experience has shown

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that water at any temperature from 60° to 95° may be used, a sufficient quantity to produce mechanical distension being the chief requisite. Even in these simple procedures due attention to detail will alone bring success. A small quantity will fail as an enema, while a temperature above 95° or below 60° will probably fail to produce emesis, as every tyro knows.

THERAPEUTIC APPLICATION.

As a mechanical agent we obtain from water important effects in the treatment and diagnosis of gastric and intestinal disturbances. In *chronic gastric catarrh*, for instance, there is no remedy equal to half a pint or a pint of hot water, above 100° F., an hour before each meal, as may be indicated in each case. This measure, which has almost become a popular craze, is now receiving more appreciation from the profession. But, like other hydriatic procedures, its efficacy depends upon attention to details. The originator of the method recommends the administration of a pint of water as hot as can be sipped, one hour before each meal, the object being to remove mucus and fermenting material from the stomach, and thus to enable it to perform its function unhampered. The correctness of the theory is demonstrated by clinical data. A half pint of hot water slowly and deliberately sipped not less than half an hour before one or all meals, as the severity of the case may indicate, will be sufficient, provided the

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stomach is occasionally irrigated with luke-warm water five hours after a meal. If the diagnosis be correct, there is no medicinal treatment or physiological aid by acid or pepsin which can approach this simple cleansing of the mucous lining. That the hot water does remove the mucus in mild cases I have demonstrated by the experiment of washing the stomach half an hour after it was drunk. When, however, the mucous is tenacious or in large quantity, it fails. It would seem unnecessary to refer to so simple a matter as the *time* for administering hot water, but I have observed failures due to the neglect of this point. A lady at Long Branch, who had been under the care of an eminent hospital physician, sought my advice for an obstinate gastric catarrh. When hot water before breakfast was ordered, she remarked that the treatment had proved inefficacious in her case after trial of several months. Inquiry elicited the fact that she had been drinking the hot water immediately before eating. The slow and gradual sipping of hot water an hour before breakfast produced a favorable change, which, together with proper diet, secured her recovery.

GASTRIC AND INTESTINAL DISTURBANCES OF INFANTS.

The mechanical effect of irrigation is the most valuable remedial measure in these affections, next to the proper attention to diet. For the removal of the ingested and multiplying bacteria from the gastro-

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intestinal canal of an infant with summer diarrhœa, irrigation by a soft rubber tube, as introduced by Epstein and earnestly advocated by Seibert, offers a valuable resource in obstinate cases, even after failure of the most reliable remedies. The method of introduction is as follows: A No. 8 Nélaton or Jacques catheter is gently but firmly pushed through the pharynx into the stomach of the child, which is held upright in the nurse's arms. In very many infants this is not a difficult procedure, as they will aid it by sucking the tube. In older children it is more difficult, and had better be avoided. The procedure should not be made in the presence of the mother, nor of anxious friends, if it can be avoided, because the occasional anxious and cyanotic appearance of the baby, although evanescent and not denoting harm, will interfere with the procedure in many instances. The catheter being lodged in the stomach, it is connected with a fountain syringe, from which simple boiled water of a temperature of 95° F. is poured. The infant will probably vomit, but it is better to disconnect the catheter from the syringe and allow the water containing products of fermentation, mucus, and undigested curds to escape through the tube. If the tube is not firmly held it will be vomited.

TECHNIQUE OF LAVAGE FOR DIAGNOSIS AND TREATMENT.

The diagnostic value of water may be referred to in connection with this branch of the subject. Its

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value as a diagnostic and therapeutic agent in dyspepsia has so frequently come under my observation that I would here briefly refer to it. There is no disease that perplexes the physician more than the various types of dyspepsia. To diagnose an ordinary gastric catarrh or a neurosis of the stomach from other forms of gastric trouble is not devoid of difficulty. When a case of chronic dyspepsia presents itself, it is my custom to bid the patient eat a full meal at 12:30 P.M. and present himself at 5:30 P.M. for irrigation of the stomach by tepid water. A long, soft, but firm, rubber tube, with open end and one eye near the latter, is introduced into the stomach. The necessary quantity of warm water, usually two to six quarts, being in readiness, a basin is placed upon a chair in front of the patient. It is well to protect the clothing of the latter by a doubled sheet or, what I use in my office, an oil-cloth apron, secured around the neck and reaching over the knees. Artificial teeth, if present, are removed. The patient is requested to sit upright with his head thrown back. The physician, standing on his right, dips the lower end of the tube in warm water (oil is unnecessary and injures the tube eventually). Holding it between the thumb and forefinger, he introduces it over the tongue, until it strikes the back of the pharynx. The patient is now told to bend his head forward. In the first effort gagging will ensue, but an abundant mucus is secreted in the throat which lubricates the tube. The

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patient should be reassured, if he feels choked or distressed, by informing him that this is the usual effect and that if he will keep his mouth well open he cannot choke, because there is ample room in the pharynx for a larger tube. The physician must refrain from sharing the patient's excitement, and by his calm demeanor reassure him when he, as is often the case, protests that he is utterly unable to do his bidding. I have failed only twice in many hundreds of instances, and I have observed that some patients, who at first declared it impossible to swallow the tube, became so expert that they executed the entire process themselves. Sometimes an obstruction is met with at the cardiac orifice, which contracts upon the tube. If an assistant will pour warm water in at this moment, the spasm will relax and the tube pass steadily down. At times it is necessary to move the introduced portion back and forth. This, however, should be avoided, because it produces gagging. It will be found that each introduction is more free from trouble and distress. The tube being introduced as far as the mark usually found upon it (which, however, may be measured in each case by laying the tube along the curve of the proposed course from the mouth to the xiphoid cartilage), the patient, or, better, an assistant, is asked to hold it lightly but securely *near the teeth*, the mouth being held open. Through a funnel connected with the upper end water is now poured into it. If vomiting ensues, the patient is

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quietly asked to lean over the basin and allow the vomit to flow out around the tube. If the irrigation is done too early after a meal, or if undigested food or large quantities of tenacious mucus obstruct the fenestrum and lower opening, the water should be poured from a height by holding the funnel up. Sometimes it may become necessary to remove the tube, clean it, and re-introduce it. This embarrasses the process greatly, if it is the initial effort. Hence it is advisable to make the first irrigation six or seven hours after luncheon, or before breakfast. The water being slowly poured into the funnel, whose lower end is firmly grasped by the physician's left thumb and index finger, flows readily into the stomach. After about a pint has been entered, the funnel, still held firmly, is turned down into the basin. This should be done quickly, *while the water is still flowing*, in order to establish siphonage. A neglect of this simple point defeats the proper emptying of the stomach. If the water does not flow out readily, the tube may be introduced farther or withdrawn a little. During the whole procedure the patient requires reassurance. I have sometimes succeeded in inducing timid patients to make the attempt, after a failure, by allowing them to witness the introduction in a well-drilled case. This is rarely necessary, however—patience, calmness, reassurance, gentleness, and skill in manipulation and overcoming obstacles will surely succeed in nearly every case.

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I have been somewhat minute in describing the technique, because experience convinces me of the value of details. The stomach should be thoroughly washed, even if several gallons of water be required, but no larger quantity than one pint should be introduced at once. The washings are now carefully inspected, when it will be readily discovered if portions of food have remained undigested. Thus a perfect clue is afforded the physician to the actual digestive powers of the patient, and the latter obtains a valuable guide. If the washings contain mucus, it is important to distinguish between stomach and throat mucus. The former is a thick, tenacious, brown mass which floats upon the surface of the water, like the scum on the surface of a pond; the throat mucus is thin, transparent, stringy, and may be more abundant, being the result of irritation by the tube of the pharynx and œsophagus. The quantity and quality of the stomach mucus indicate with some accuracy the condition of the gastric mucous membrane. Its rapid or slow disappearance under renewed irrigations and treatment indicates the character of the disease affecting the mucous lining. Three cases recently treated in this manner may serve as illustrations of the diagnostic and therapeutic significance of warm water irrigations in stomach troubles.

J. M., a young college student, complained last winter of severe pain in the epigastric region, without other symptoms of dyspepsia. Various forms

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of diet, amounting at times almost to starvation, afforded no relief. Bismuth and magnesia, hydrochloric acid, hot water before meals, and other remedies only afforded temporary relief in the course of several months. A sojourn in the country completely restored him. On his return he apprenticed himself to a microscope manufacturer. This occupation being sedentary and his mid-day meal taken hastily at a restaurant, the old trouble very soon developed. The pain now became so severe that he often refrained from eating to avoid it. He was constipated and suffered from eructations. A full meal, consisting of soup, fish, meat, and vegetables, was ordered at 12:30, and his stomach was washed out five hours later. A small quantity of bread, some celery, and spinach appeared undigested, *the remainder of his food being disposed of*. Pain was almost unbearable until the stomach was cleaned, when it ceased at once. The entire surface of the water in the basin was covered with a thick, brown mucus. The diagnosis of chronic gastric catarrh, due to prolonged nervous dyspepsia, was made, and the following simple treatment was adopted: He was ordered an aloes and mastic pill every night, a meat pulp diet, irrigations of the stomach every second day, and pulv. magnesia for pain. The stomach was washed nine times, the interval being prolonged as the course of treatment progressed. The pain returned but once, the patient remaining entirely free from it until he re-

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sumed his college studies. He was ordered hot water before breakfast, and gradual return to ordinary diet. In this case the same care in diet had been ineffectual until the cleansing of the stomach prepared the way for the more successful dietetic and hygienic management.

When the case is not of long duration nor of secondary origin, and the patient is young, complete recovery may be almost invariably obtained by this simple diagnostic aid. In the more chronic cases other management, to be presently detailed, is indicated. Another case in which the diagnosis by irrigation rendered treatment successful may be of value:

Miss M., an anæmic young lady, presented every symptom of gastric catarrh, with the addition of occasional vomiting of mucus and food, and severe pain in the epigastric region. She had been treated several months without success, but was immediately relieved by an exclusive diet of hot milk and seltzer water, gradually increased to chopped meat diet, preceded by hot water. A cautious return to a more varied diet brought a return of pain, with increased violence; eructations of gas were explosive, and her condition was precarious. Five hours after a test meal, her stomach was irrigated, and it was discovered she had digested her food well. A small quantity of tenacious stomach mucus floated out, portions of which were so deeply tinged with blood that they appeared like pieces of beef pulp. Diagnosis of

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ulcus ventriculi was now clear. Stomach irrigation was therefore refrained from. The usual treatment by rest in bed, systematic nutrition by milk, sarco-peptones, and farinaceous food, with alkalies, completely changed the aspect of the case in a few days. It was continued two months, and now the patient is in perfect health, eating a mixed diet, and gaining flesh rapidly. There had never been the slightest evidence of blood in her ejecta, and she had been treated by several physicians, including myself, for gastric catarrh, until irrigations made the diagnosis clear.

Dr. H. asked me (March 4th, 1890), after reading the account of the above cases I had given in a paper before the New York County Medical Society, to wash his stomach for diagnosis. Patient looked haggard; suffered from migraine; had worked hard as a country practitioner for eighteen years; vomited continuously, with headache; had tried everything, including rest for eight months; dieted carefully; no serious gastric distress after eating. An eminent authority had diagnosed gastric catarrh, and had put him on meat diet. He had had section of external rectus of both eyes; thought to be astigmatic; sleeps well. Dr. Carl Koller found no error of refraction. My diagnosis of nervous dyspepsia was confirmed by the entire absence of mucus and complete digestion of all food taken five hours previously, which surprised the patient greatly. A mixed diet was ordered, which, together with hydrotherapy externally applied, relieved him greatly.

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It might be claimed that these cases might have been diagnosed without the aid of stomach irrigation. But I cannot over-estimate the assistance which these ocular demonstrations constantly afford me. Moreover, the moral effect upon a hypochondriacal patient, who sees the mucus gradually diminishing, is not an insignificant factor in the treatment of some of these trying cases.

GASTRIC IRRIGATION IN TREATMENT.

In the management of long-standing gastric catarrh, the most unpromising cases that come under my care, the diagnosis may be at once established, but the treatment by irrigation is not so successful as in those of recent origin. As an addition to hygienic and dietetic management, the latter is useful, however, inasmuch as it frees the stomach thoroughly from accumulations of fermenting material and tenacious mucus, and prevents the over-distension by gases, which paralyzes the motor functions of the gastric walls, and forms an almost insurmountable obstacle to recovery.

Much discussion has been caused by the time at which these irrigations are most useful. Riegel and others insist that at bedtime this lavage is most useful, because it enables the stomach to be restored to a nearly normal condition, free from fermenting material and particles of undigested matter, during the night. There is doubtless good reason for his

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preference, but in those parts of this country, especially in cities, where the evening meal is usually about three and a-half or four hours before retiring, much good nutritive material is lost by the practice; hence, as a rule, it is desirable to resort to irrigation in the morning, except in cases which are under constant supervision, in which the interval between the last meal and the irrigation may be made longer, and the meal of less substantial food. Hence the time must depend a good deal upon the individual case. When, for instance, we have a case characterized by accumulation of large quantities of tenacious mucus, which interferes with digestion and demands large quantities of water, I am in the habit of washing the stomach before dinner, directing the patient to take his luncheon of some light broth or hot milk at noon. Five hours suffice for their digestion; if they have not been disposed of in six, it is probable that they will be propelled into the bowel undigested, and will, therefore, be lost to nutrition. Hence a luncheon at 12 and lavage at 6 is most suitable in business-men and women. I have recently had a busy lawyer under my care, in whom the products of decomposition produced an offensive odor in the washings, mingled, as they were, with such enormous quantities of mucus that six to eight quarts of water were required for complete cleansing. He vomited, prior to treatment, every other day for months, and then, being partly free from the accumulations, managed to attend to

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his business. There was not a particle of hydrochloric acid in his stomach, according to frequent analyses. The motor power was so far in abeyance that articles of food were recognized in the washings twenty-four hours after he had partaken of them. This case was completely *relieved of his symptoms*, requiring now only bi-weekly washings. It proved to be a case of stricture of malignant character, to which the patient finally succumbed. Lavage served to make life tolerable and to prolong it.

When the motor function of the stomach is impaired without other organic involvements, as in anæmia or other conditions which depreciate the general muscular and nerve tone, lavage should not be resorted to habitually. A weekly or bi-weekly evacuation suffices for diagnostic, prognostic, and therapeutic purposes, while other appropriate treatment is resorted to for the restoration of the general condition.

LAVAGE COMBINED WITH EXTERNAL HYDROTHERAPY.

Miss W., daughter of an Ohio physician, æt. 23, anæmic, applied for treatment May 15th, 1889. She had been ill three years; at first suffered fainting fits at menstrual period; afterwards violent pains in right hand, traversing body and concentrating in epigastrium, for which her father administered morphia for a month. Her stomach then became irritable, and has continued so until the present time; she vomited

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and spat up nearly all her food, more frequently solids. Sea-baths did not improve her. She studied hard, and got worse. In the fall of 1888 she lived on milk and farinaceous mush, and her stomach was washed out regularly, but she grew worse. She now became emaciated, took peptonized milk for a month, but vomited it; tried meat with same effect. Last fall she lived on grapes, which agreed with her. Had tonics, pepsin, and all possible medication her father and brother could muster, without avail. She was sent to me by Dr. Francke Bosworth, after being in the city for three weeks without improvement. She now vomits every day, is anæmic and depressed. She traces her ailment to painting-lessons, but I drew from her a history of a potent psychical factor as a cause in the sudden violent insanity of the favored nurse of her childhood.

Diagnosis: Gastric neurasthenia of the pure type. Stomach was washed twice a week to remove mucus and fermenting material. General faradization daily, also the wet sheet. She received a brisk rubbing over the snugly applied dripping sheet (water at 60° F.), while she stood in a tub of warm water. Under this general treatment vomiting ceased entirely. She went to the seaside improved in July, and on her homeward journey called to tell me that she had grown stout and felt perfectly well. A year later she writes: "You would not recognize me as the same girl whom you treated."

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When retention of undigested matter and production of decomposition are due to pathological dilatation, and thus impair the motor functions, lavage may be practiced with advantage as often as is necessary to cleanse the stomach. It will be useful as an adjunct as well as a curative agent. Life may be prolonged, in malignant cases especially, by this simple hydriatic procedure.

DILATATION OF THE STOMACH.

Kussmaul held long ago, and his view has been found correct by myself and many other observers, that the stomach tube, by completely emptying the stomach, may restore the contractile capacity of the stomach walls, if they have not been entirely exhausted, just as the catheter does in ischuria occasionally.

In all cases of this kind, due to actual stricture or simply to gastric catarrh, with excessive fermentation, aided by mucus, which encourages the formation of butyric acid, gastric irrigation a long time after meals, either before dinner or breakfast, is perhaps the most valuable therapeutic resource we have, if cautiously introduced. In nervous dyspepsia it is advisable not to be urged to too frequent irrigation by the alleged gastric fulness of which the patients complain. An occasional irrigation cleanses the stomach of possible, though rare, accumulations, and exerts a psychical effect which is of some value. The

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products of fermentation require occasional removal. The use of small quantities of ice-water by lavage acts as a douche upon the stomach walls, and aids other means, such as electricity, etc., in restoring its tone.

GASTRALGIA.

In this painful malady, even when not dependent upon accumulated fermented material (which, by the way, is its most frequent source), the irrigation with hot water acts as would a poultice to an external sensitive part. A striking case is reported from Kussmaul's Clinic. A woman, 22 years of age, teacher, suffered after three years of dyspepsia from agonizing gastralgia, which failed to yield to all remedies, including electricity, wet compresses, blisters, etc., and yielded only to morphia. Becoming habituated to the latter, she gave up work, and entered the clinic in a miserable condition, feeble, emaciated, dirty pale; abdominal wall covered by cicatrical knots from hypodermatics, etc. Diet, rest, etc., were unavailing; morphine was still required. Her stomach was now irrigated with warm water every morning, while empty. The water returned almost clear and a little acid. This was continued with advantage to pain and renewal of appetite. Carbonized water, mixed with plain water at 100°, was now substituted, 2–3 litres being used. In three weeks she could eat beefsteak, etc., and take a walk. Warm baths at night, of 10 minutes' duration, were

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now adminlstered with great benefit. The morphine injection gradually became less necessary. To aid in obtaining spontaneous actions of the bowels faradization was produced by introducing a wire electrode through the tube into the half filled stomach, and placing another electrode upon the outside for five minutes. In four weeks she was entirely restored. In cases in which the soothing effect of warm irrigation is desired, it is self-evident that the warm water should be allowed to remain in the stomach for several minutes, and repetition resorted to.

INTESTINAL OBSTRUCTIONS.

Another valuable application of water, discovered by Kussmaul in 1882 and published in 1884, is the treatment of Ileus by irrigation of the stomach with a large volume of warm water. We certainly encounter no class of cases which afford us more anxiety. Hitherto their non-surgical treatment consisted of purgatives, enemata of water or air, the injection of large quantities of crude mercury, and, lastly, opiates—remedies to which many cases, even those that are not due to actual stenosis, fail to yield. Hence we welcome any addition to our measures with due appreciation. The first case treated by Kussmaul was admitted into his hospital in March, 1882, having been unsuccessfully treated by all the usual methods for eight days. The stomach was thoroughly washed out, feculent masses were evac-

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uated, and the irrigation was repeated every three or four hours until the water came away clear. Patient fell asleep for the first time, and on awakening passed a thin, yellow stool. No further treatment was necessary; recovery was complete in five weeks.

A second case occurred a year later. Here, again, all remedies had been exhausted for nine days without result. Laparotomy was determined upon, but Professor Lücke, the surgeon, requested Kussmaul to see the patient before operating. One large irrigation of the stomach removed immense masses of feculent matter, and was followed by sleep, which had been denied the patient even under large doses of morphine. Other cases have been reported by Senator and others, in some of which stomach irrigation acted as a curative, in others as a very comforting palliative agent, when surgical interference became necessary, the distressing vomiting and great distension being removed. We have in this hydriatic procedure a valuable means, which should never be neglected, ere laparotomy is decided upon, and after its failure we may more promptly decide upon laparotomy than hitherto.

In a case occurring in my own service at the Manhattan Hospital, stercoraceous vomiting and the terrific urgent straining accompanying or succeeding it in a case of stenosis were so completely allayed as to lull the house staff into a false sense of security, from which the collapsed condition of the patient aroused

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them. Laparotomy by Dr. Wilkie revealed one intussusception and one constriction by bands. The value of the hot water irrigation as an anti-emetic is here illustrated in an extreme case.

COLIC FROM GALLSTONES.

In the discussion of Senator's paper, Rosenthal referred to the fact that in two cases of colic from gallstones irrigation of the stomach not alone relieved the pain and vomiting, but the gallstones were seen in the fæces. Although I have failed to obtain any such result from this treatment, its simplicity commends it for repetition in other cases.

It is well to remember the statements here reproduced by such men as Kussmaul, Senator, and Rosenthal, when we are face to face with these distressing cases.

INTESTINAL IRRIGATION—TECHNIQUE IN INFANTILE DIARRHŒA.

This is a remedy in the diarrhœa and dysentery of infants which affords more comfort to the doctor and security to the patient than the whole materia medica. I say this advisedly after an experience of thirty-one years in a large general practice in a country and city clientèle. But it must be borne in mind that irrigation cannot be accomplished by an *enema* of warm water, this would act as an irritant and create additional disturbance. A rubber horse catheter or a Nélaton catheter should be used for this purpose, be-

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cause its walls are firm and yet elastic, and its length admits of its deep introduction. It should be attached to a fountain syringe, containing one quart of water that has been boiled for half an hour, and in which half a drachm of chloride of sodium has been dissolved. The infant is placed upon the abdomen in the lap of the attendant. The tube, anointed with vaseline and firmly held between the thumb and index finger of the right hand, is gently introduced into the anus. The pressure of the fingers is now somewhat relaxed, in order that the water may flow, while the tube is being gently but firmly pushed into the intestinal canal. Whenever it meets an obstruction it should be withdrawn a little and gently persuaded to pass upward. If the water is allowed to flow and distend the bowel, introduction is greatly facilitated. Remembrance of this point has frequently saved me the mortification of abandoning the introduction. Sometimes it is more readily introduced when disconnected from the syringe. When the upper point has reached the transverse colon, or cannot be introduced farther, it is held quietly until about a quart of water has been passed. There will be no distension, because the pressure of the child's body upon the nurse's lap will aid in expelling the water as rapidly as it is introduced. If it does not return it may be allowed to run out through the catheter. I have sometimes in extreme cases added with advantage one-half grain bichloride of mercury to the quart of water,

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allowing always an extra pint of plain water to follow the medicated injection to prevent poisoning.

Experience has convinced me that thorough irrigation of the large intestine, administered by the physician or by a competent nurse, under special instruction, every four or five hours, lessens the number and changes the character of the movements, and produces a most soothing effect upon the patient. I have frequently seen infants who had been tossing in pain, purging and vomiting, drop into gentle slumber while the water was still flowing. Almost invariably a quiet slumber follows the irrigation, the purging ceases or is much modified, and the whole aspect of the case is changed. The result of irrigation is the removal of bacteria, mucus, undigested food, and fermenting material.

RATIONALE OF ACTION.

J. L. Smith has found the lesions in summer diarrhœa "in all but one of the cases in the colon; in thirty-nine, nearly or quite through its entire extent; in fourteen it was confined to the descending colon. The portion of colon most frequently inflamed is just above the sigmoid flexure."

"The large intestine, the cæcum, sigmoid flexure, and upper part of the rectum were the positions in which the most advanced lesions were met with. In the small intestine the changes were generally limited to the lower part of the ileum," says Holt in the Med-

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ical News of June 9, 1888. Hence we may safely assume that the irrigations reach most of the diseased surface, and thus we follow the indications of modern therapeutics, to *treat local troubles by local measures*, as far as possible. The inflamed parts are not only soothed by these warm irrigations, but the materies morbi, which maintain the disease, are removed and neutralized.

An incidental advantage, too, is the stimulation of the hepatic function which this imitation of Krull's injections produces. While I have, in severe cases of *dysentery*, resorted to the addition of bi-chloride of mercury with advantage, I regard the addition of antiseptics to the irrigating fluid as inadvisable, inasmuch as the solutions cannot be made sufficiently concentrated to effect the destruction of germs and spores without endangering the integrity of the mucous membrane, or menacing the system by poisoning from absorption. Further investigations may develop a perfected medicinal irrigation. For instance, Cantani's method of tannin irrigations in cholera may be here imitated. He has succeeded in reaching the stomach with these irrigations. In chronic and subacute cases these may be valuable by their local astringent action.

CATARRHAL JAUNDICE.

About ten years ago Dr. Krull, a German physician, treated eleven cases of catarrhal jaundice by

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simple cold water irrigations of the intestines. After failure with other treatments, which almost invariably had included the Carlsbad waters, these irrigations succeeded, first, in relieving the constipation and, later, in re-establishing the hepatic norm. Dr. Löwenthal reports (Berl. Klin. Wochenschrift, 1886) forty-one cases of catarrhal jaundice, in which all but one demonstrated good and rapid effects from intestinal (anal) irrigations. Four irrigations of one to two quarts of a temperature varying from 54° to 64° F., increasing three degrees daily (one quart sufficing for children), were needed on an average for each case. In all cases fæcal evacuations followed the irrigations, sometimes diarrhœa; these ceased if the succeeding irrigation was of a somewhat higher temperature. Grey or colorless clay-like masses were evacuated after the first treatment; after the third the fæces became slightly yellowish, and after the fourth, usually brown. Gastric pains and oppression, headache, etc., ceased, appetite returned; icteric hue disappeared once after the first, twice after the second irrigation. Pruritus, among seven cases, disappeared after from the second to the fourth treatment. The skin began to clear up, but continued dark for a long time. There were 27 male and 14 female patients; in most of them the cause lay in disturbances of the digestion; two claimed sudden fright as causes. Other reports of similar results are found in recent literature, confirming the value of this *hydriatic meas-*

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ure, so that it may be regarded as established. I can testify from personal experience to its beneficial effect in catarrhal jaundice, and to its failure in jaundice from gallstones. Once in 24 hours I place the patient in the knee-elbow position, and pour from one to two quarts of water of 54° to 60° F. into the rectum from a fountain syringe. The patient is induced to retain the fluid as long as possible. On the following day the temperature of the water is increased two degrees, and this increase is continued until 70° F. is reached. From two to six irrigations are sufficient to produce the desired result. In my own experience the gastric and hepatic pains ceased after the first injections, appetite soon returned, and jaundice disappeared more or less rapidly, but I failed in subduing the pruritus by this measure.

DYSENTERY.

In acute dysentery of infants, as well as of adults, irrigation with water, about 95°, made thoroughly aseptic by long boiling, has proved in the hands of the best clinical observers a valuable auxiliary by removing pathological products, subduing hyperæmia, relieving tenesmus, and thus enabling the inflamed bowel to obtain that rest which in all inflammatory affections is the chief element of restoration. All these effects are due to the mechanical cleansing action of water. They demand careful attention to the details of the procedure, which, though simple,

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experience has taught me are necessary to be inculcated. How not to do it is illustrated by the case cited in the opening of this chapter.

Clinical evidence of the value of this simple hydriatic measure is readily obtained. The most recent report on the subject I find in the Medical Age, Aug. 25th, 1891. Dr. Peter S. Korytin (Russia) details fifteen successive cases of diphtheritic (9) and catarrhal (6) dysentery which he treated daily with warm (30° R. or 100° F.) large enemata of six pints either of filtered water from the tap or of a carbolic solution, 10 to 20 grains to the 6 pints of distilled water, which is practically equivalent to plain water. Only one of the patients died, the remaining fourteen making excellent recoveries. The total number of the injections in individual cases varied from one to six, averaging two and a half. The injected fluid was retained by the patient generally from five to ten minutes, being sometimes expelled in one or two, and in other cases in from fifteen to twenty, minutes. The following effects were commonly observed: Abnormal distension and pain speedily subsided; the frequency of stools diminished and tenesmus decreased; the spirits, appetite, and sleep quickly improved; the stools soon became painless, more solid, and free from offensive odor, mucus, blood, sloughs, and shreds, while the temperature became normal. No therapeutical difference whatever was noticed between carbolic and simple enemata. It appears,

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therefore, that the beneficial results of the treatment should be attributed simply to the thorough washing out of the large intestine. (See Dr. Hiram Corson's views, page 16.)

LEAD COLIC.

Reisland published in the Berliner Klin. Wochenschrift, 1875, an obstinate case of this disease in a potter. He had been constipated for five days, despite the most active purgation; he was collapsed, with frequent spasms of the arms and legs and vomiting of bile; face pale and ashen. The teeth presented a plain lead line; abdomen, hard and retracted; pulse, small (65); temperature, normal. Croton oil and opiates were ineffectual, also enemata. Four and a half litres of warm water were now poured into the bowel with a Hegar's irrigator. The water returned in five minutes, colored by fæces and containing some scybala. He obtained so much relief that the patient insisted upon a repetition. Three litres were introduced, and were followed in half an hour by the same quantity, each injection being followed by fæces and relief from pain. The knee-elbow position was practiced during irrigation. The patient became more nauseated, but after the third irrigation he slept well for the first time in six days. The pain returned, and three more injections of three and two and one-half litres brought stools and relief. On the following day the pain and spasms returned, and were again relieved by irrigation. He received one more irrigation

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of three litres, which brought a good fæcal evacuation, and he was assisted to entire recovery by a dose of *Ol. Ricini* and *Ol. Crotoni* and a warm bath. In Kussmaul's Clinic at Freiburg this treatment has been used for many years. Whether lead colic be a neurosis of the intestinal muscular coat, or, as Riegel deduces from the effect of amyl and pilocarpine, a spasm of the mesenteric vessels, it is certain that abundant warm injections per anum may avert a colic in its incipiency, and act as a good palliative. It is very interesting to note that this procedure quickly produces fæcal evacuations, irrespective of the rejected enemata, proving that they induce a normal activity of the intestine. The experiments of Horvath, who sent streams of water through portions of the intestines of living animals, demonstrate that the passage of water (66° to 105° progressively) through the intestines excites peristalsis (Malbrane, Berl. Klin. W., 1878).

WATER IN GYNÆCOLOGY.

Another illustration of the distinctly local effects of water is the application of hot water in some diseases of the female pelvic organs. Those who in former years ordered injections of cold water, in which tannin, sulphate of zinc, alum, or other astringents had been dissolved, for checking leucorrhœa, for healing so-called ulceration, and so forth, are in a position to appreciate the immense advance which the introduction of hot vaginal douches has inaugur-

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ated. If Dr. T. A. Emmet had done nothing more for gynæcology, our debt of gratitude would be great indeed. But here, as in all other applications of water as a therapeutic measure, everything depends upon details—the method and the temperature (110° F.). He claims, moreover, that it is impossible for a patient to give these injections to herself so as to derive their full benefit. So different is the corrugating, and therefore tonic, effect of these injections, when administered according to his rules, that Dr. Emmet discovered by digital examination those women who, among a series in the Woman's Hospital, had been given injections without their guidance. "We resort," says Dr. Emmet, "to the prolonged use of hot vaginal injections to gradually bring about the required contraction and to tone the pelvic vessels. Whenever inflammation exists, there is essentially a congestion of the arterial capillaries, and when it subsides there remains, among other results, a condition erroneously termed chronic inflammation, a condition essentially the same as the one just described, attended with a loss of tone in the vessels and an obstructed circulation; but it is a misnomer, since it is found where no previous inflammation has existed. The usual seat of the so-called inflammation, and the circumstances under which it is generally found, have already been stated, as well as the fact that what we have chiefly to deal with is the direct results of a loss of tone in the venous circulation throughout the

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pelvis. The use of hot water vaginal injections is equally beneficial in all those conditions which constitute the various forms of disease in the female organs of generation, and which are amenable to any treatment other than a surgical procedure, and equally so whether the congestion is venous or arterial. This remedy is not to be considered a cure-all, but one of the most valuable adjuncts, under all circumstances, to other means. Yet, so beneficial is it, except in displacements of the uterus, that, I believe, more can be accomplished in the treatment of the diseases of women by its use and a carefully regulated plan of general treatment than by all other means combined. After a vaginal injection has been properly administered in accordance with the directions given in Chapter V, the mucous membrane will be found blanched in appearance and the usual calibre of the canal lessened, as after the use of a strong astringent injection. As the patient lies on the back, with her hips elevated, the blood will be aided by gravity in its return to the heart, and the veins will be rapidly emptied sufficiently to relieve their over-distension. In this position, also, the vagina will be kept fully distended by the weight of the water, and only the surplus amount can run off into the bed-pan beneath. The hot water will then be in contact with every portion of the mucous membrane under which the capillaries lie. The vessels going to and from the cervix and body of the uterus pass along the sul-

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cus on each side of the vagina, and their branches enclose the vagina in a complete network. The vessels of the fundus, through the veins of which the blood flows to the liver and back into the general circulation, communicate freely, by an anastomosis, with the vessels distributed to the body and cervix below.

If, then, we are able to cause the vessels of the vagina to contract, through the stimulus of the hot water, we can, directly or indirectly, influence the whole pelvic circulation. It is most important to appreciate the necessity for elevating the hips, by which plan so large a portion of the venous blood becomes drawn off by gravitation. If the stimulus of the hot water is then applied, so as to cause the vessels to contract still more, we shall, for a time at least, have the pelvic circulation reduced almost to its natural state. In order to allow the contraction to be as prolonged as possible, I generally direct the injection to be given at night, in bed, just as the patient is ready to retire. Thus, by constantly causing the vessels to contract, and by resorting to every other means of lessening the supply of blood in the pelvis, we shall succeed eventually in securing a proper vascular tone. No plan of treatment could be more rational or appeal more forcibly to sound judgment. But, unfortunately, owing to a *neglect of details*, it is rare that the slightest benefit is derived from the use of the injections, although so many years have elapsed

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since the profession has been fully informed as to their mode of action. For fifteen years at least to the time of writing I have been experimenting by different methods in the use of hot water, and have had during that time as large a number of cases as would be likely to be at the service of any practitioner, and I have arrived at the conclusion that it is an impossibility for a patient to properly give these injections to herself so as to derive their full benefit. Not the slightest advantage is received from them when administered with the patient in the upright position, or, as is the usual method, while seated over a bidet; for, given thus, the water does not dilate the vagina, but escapes directly along the nozzle of the syringe. I have found that the best mode of all is to have the injections while the patient is placed on her knees and elbows or chest. In this position we have the assistance both of gravity and of the pressure of the atmosphere to empty the pelvic veins, while the water is able to act on a much larger surface of the vagina than it is when the patient is in any other position. But this position is a difficult one to assume, since those who are in the greatest need of hot water have not the strength to remain in it long enough to secure the full benefit; considerable difficulty is also experienced in keeping the patient dry. This latter, however, can in a measure be overcome by using a funnel-shaped receptacle with an india-rubber tube attached to the smaller end, the two sides being indented suffi-

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ciently to enable the patient to retain it in place by keeping the thighs together. I have also used an inclined plane to elevate the hips; it should come between the legs and have a hole large enough for the buttock, so that the water may flow into a receptacle below. These methods, or any other which the ingenuity of the physician may suggest, can be employed, so long as the action of gravity is brought into play and the vagina is fully dilated by the water. But, for the largest number of cases, the position on the back, with the bed-pan to elevate the hips, will be found the most convenient. Few women are so situated as to be unable to get somebody to administer the injection properly, and the inconvenience of soliciting aid is a trifling one considering the benefit to be derived from it. Experience, too, has shown that, *unless details can be carried out fully*, the process only involves a waste of time and a tax on the strength of the patient. The temperature and quantity of water are to be varied according to circumstances. When the early stages of inflammation are under treatment, it is necessary that the temperature should be elevated rapidly from that of blood heat to 110°, or to as high a degree as can be borne by the patient, and that the injection should be often repeated. For ordinary use a gallon of water, two or three degrees above blood heat, is generally sufficient, but the temperature must be maintained at the highest point by the addition of hot water from time to time. The hour of

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bed-time is generally the best in which to seek for the beneficial effects of hot water upon the local irritation; for a prolonged vaginal injection, at a high temperature, will often, when given by an experienced hand, act with more promptness than an anodyne in allaying the nervousness and sleeplessness of a hysterical woman. I have frequently known a patient, after being well rubbed and having received an injection, to fall asleep before the nurse had completed the process, and to be so overcome with drowsiness as to be but little disturbed when the bed-pan was removed.

"In rare instances, and from a condition I am unable to explain, cases are met with where a sense of weight and an uncomfortable feeling are experienced about the pelvis after an injection of water at the usual temperature. In some instances so much disturbance has resulted that I have been obliged to discontinue its use. But I have long since ascertained that the injection is well borne in these cases at a lower temperature, generally about 95° F., and that after a week or two the temperature can be gradually increased. This 'cooking process,' as it has been slightingly termed, is rendered easier by the use of ivory or some non-conducting material for the nozzle of the syringe, since the patient suffers more discomfort from the heated metal of the ordinary nozzle coming in contact with the outlet vagina than from any degree of heat in the water which it is advisable to employ."

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The originator's own words have been preferably reproduced here because the author can corroborate from personal observation that here, as in all other hydriatic procedures, exact appreciation of the technique and rationale will enable the practitioner to obtain the positive benefits resulting from this valuable measure.

WATER IN SURGERY.

The most important advance of modern times in hydrotherapy, and one which has always been overlooked or not credited to the latter, is the recognition of hot water as the chief means of rendering wounds aseptic. More lives have been and will be saved by the appreciation of this fact than by any other connected with this subject. Here, too, an intelligent recognition of the principle involved (cleanliness) will lead to success. It will afford at once a conception of the importance of the method if we briefly compare that now in vogue with that of the past. We need not go very far back for the reason. During the late civil war between the States water was a prominent element in surgical practice. My personal experience, as a regimental, field, and hospital surgeon, was as follows: All wounds were cleansed with cold (rarely warm) water, conveyed by sponges; compresses of patent lint, moistened with cold water, were applied, and these were carefully held in position by bandages and moistened from time to time.

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As soon as suppuration commenced the wounds were sponged and syringed with warm water, and the dressings were kept moist with cold water. That many wounded recovered under this treatment is true, but that it was an improper method the frequent active and exhausting suppuration, the not infrequent accumulation of maggots, the common complications of erysipelas, septicæmia, and gangrene, and the comparative immunity from these undesirable complications under the modern dry treatment of wounds, amply demonstrate. The modern idea would eliminate water from the treatment of most wounds. During amputations, resections, and other operations, cold water was freely poured over the field of operations by means of large sponges. How much more gentle is the *modern method of irrigating* the exposed structures; how much more effective in reaching every nook and recess of the wound, which would escape the sponge or require its rude application! But there is still room for improvement in our boasted modern management during operations. It appears to me that the temperature of the irrigating fluid should approximate that of the body, and not be obtained from a cold bottle. The same principle which demands warm water for laparotomy should apply to the less sensitive, but certainly not callous, parts involved in amputations.

It is one of the triumphs of water in modern surgery that experience has demonstrated the value of boiled water as an antiseptic in laparotomy.

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HOT WATER THE BEST ASEPTIC AGENT.

The conviction is slowly gaining upon the surgical mind that the various medications resorted to, to render water aseptic, would become unnecessary if the proper preparation of the water and the proper temperature during its application were scrupulously attended to. Here the temperature of the water is an element of such decided import that it must be evident to the most superficial observer.

HOT WATER AS A STYPTIC, ETC.

The application of hot water as a styptic and to prevent shock is of modern origin, and need only be referred to here to demonstrate the enormous and formerly disregarded value of this purely hydriatic measure. In post-partum hæmorrhage intra-uterine injections with plain hot water are our chief reliance. They leave the uterus in an aseptic condition, which contrasts favorably with that remaining after the formerly vaunted persulphate of iron injection. In the former case the uterus is left clean and free from coagula, while in the latter it is filled with firm clots, whose removal must be accomplished by processes that may produce septic conditions.

The improvement of modern wound treatment is not due so much to the appreciation of certain antiseptics, as to the proper *application of water* as a cleansing agent before and during operations, and, what is equally as important, the abolition of its abuse

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after operations. The correct appreciation of the true functions of water in surgery, aided by the prolonged rest of the wound from the disturbances hitherto practiced, by repeated cleansings and ablutions—a rest which is provided by permanent dry antiseptic dressings—these are the true causes of the enormous reduction of mortality from wounds in recent times. This fact, daily emphasized by clinical experience, cannot be too energetically inculcated into the mind of the profession, especially of its younger members, since the idea seems to dominate many that if corrosive sublimate, carbolic acid, or other antiseptic be applied in proper solution to wounds, all indications have been fulfilled. I hold that thorough cleaning of the field of operations by hot water and soap, and thorough irrigation of the wounded surface—in other words, strict cleanliness enforced by the abundance of hot water used without stint—will be the surgical antiseptic of the future. Then cleanliness will indeed lead to godliness, for it is godly to succor suffering humanity.

CONTRA-INDICATIONS TO THE USE OF WATER.

It is important to point out that water, like every other therapeutic agent of potent action, should be used with caution. Not only, as has been pointed out, is it imperative to adhere closely to a precise technique and to understand its rationale, but even the simple application of water may prove detri-

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mental. In eczema, for instance, it is now a recognized principle to *abstain* from the use of water altogether. Formerly, bathing an eczematous surface was regarded as a *sine quâ non* of the therapy of this disease.

That this is an error, personal experience has again and again demonstrated. I well remember a young colleague who suffered from a chronic eczema of the hands, for which he had been unsuccessfully treated *secundum artem* by zinc, tar, and other ointments, and rubber gloves. The suggestion to refrain from washing the parts led to an early recovery. Many instances of a similar kind have come under my observation. I refer to this apparently trivial point especially because it is a modern observation of which personal cognizance extends only to about six years, and from which I have derived more satisfaction than from all other so-called improvements in treatment of chronic eczema.

IN OTITIS MEDIA.

Another contra-indication may be found in the frequent injection of warm water in chronic suppurating *otitis media*. Numbers of observations, made when in charge of the eye and ear classes of two of our dispensaries some years ago, have convinced me that this is a practice which often maintains the suppuration, macerating the inflamed and, sometimes, fungoid edges of the perforation, and proving a serious obstacle to recovery. The simple refraining from

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injections and the substitution of the dry boracic acid treatment have afforded me brilliant results in the most obstinate cases. This was well illustrated in a lady who, in early life, had been a patient of Pòlitzer, but had been later under simultaneous treatment by an eminent laryngologist and an otologist of New York. The discharge was offensive and profuse, and had on this occasion been constant for six years. The syringe had been faithfully used to prevent unpleasant odor and check the suppurative process. The entire cessation of the ulceration, treated with dry boracic acid packing, established a complete cure in a few days.

IN NORMAL PUERPERAL CONDITION.

A third contra indication to the local use of water, which I am glad to have been instrumental in enforcing several years ago, is the injection of warm water, with and without antiseptics, after normal labor. Valuable as this measure is after the comparatively rare abnormal labors when it is probable that septic material has been introduced by the frequent examinations or by instruments, or may have been formed by decomposition of bruised and decaying tissues or retained secundines, *abstention from these injections after normal labors* should be the first rule of management of the puerpera.

In several papers before our medical societies I have offered practical facts, not theoretical arguments, to demonstrate that vaginal injections after normal

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labor and in the normal puerperal period are not only devoid of value as a prophylactic measure, but that they may prove a veritable Trojan horse, admitting the enemy, to whom we are energetically striving to deny entrance, into the precincts of the vagina, and thus letting loose the destructive elements among the torn and raw surfaces which expose the lymphatics. That this warning is not out of place, even at the present day, is evidenced by the fact that in the London Lancet of January 21, 1891, an article appeared from the pen of one of the physicians to the Rotunda Hospital, warmly advocating the washing out of the uterine cavity with hot water as a *routine* treatment in private and hospital practice. Coming from the school which first taught that "meddlesome midwifery is bad" with regard to instrumental labors, such dangerous interference is, to say the least, singular at a time when modern obstetrical art applies it not only to instruments, but even goes so far as to eschew digital examinations. (Leopold, of Dresden, forbids these to the students, in order to favor asepsis of the vagina.) Hence the author is warranted in entering the contra indication to the use of water in this treatise upon water in general, viz., to abstain from its introduction into the vagina after normal labors.

It is as important to know how and when *not to use* water as how and when to use it, because, as will frequently appear, water is powerful for evil as well as for good.

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THE USES OF WATER

IN MODERN MEDICINE.

BY

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CHAPTER I.

TECHNIQUE OF HYDROTHERAPY—PROCEDURES HAVING FOR THEIR OBJECT GENERAL EFFECTS.

In describing these procedures, only those will be referred to whose action has been found of value in the author's personal experience or observation. Many subdivisions—as head-baths, wrist-baths, arm-baths, etc.—which are found in the books of the hydropaths and in some regular treatises, will, therefore, be omitted. It is the aim of this work to simplify hydrotherapy and render it accessible as far as possible to the general practitioner. It must be reiterated here, however, that *minute attention to details* is the first essential for the successful application of all hydriatic procedures.

ABLUTIONS.

The simplest hydriatic procedure is the local or general ablution. It serves as an introduction to more active measures. It consists of the application of water by the hand, either naked or covered by a bath glove or holding a linen wash-cloth. The sponge is to be avoided because it does not produce sufficient friction and discourages reaction. The

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method and the temperature of the water vary with the object in view. Several vessels filled with water of proper temperatures must be within reach. In acute febrile affections, with temperature above 101° F., an oil cloth or rubber sheet is laid upon one side of the bed, covered by a blanket, and upon this a linen sheet or tablecloth is spread, one-half reaching over the edge of the bed, the other rolled upon the other half of the latter. The patient is now placed upon the sheet, his face is bathed with water from 65° to 50°, beginning with the higher temperature, and on each application reducing it two or more degrees. The chest and arms, the back, abdomen, and lower extremities are successively bathed by freely applying the water. This is far superior to sponging, which chills by evaporation, while the gentle shock of the impact of the water applied in this method, accompanied and followed by gentle friction, arouses the peripheral nerves, and thus refreshes the entire system by its reflex agency. The difference of refreshing effect is made evident by comparing, in the ordinary morning toilet, the simple moistening of the face with a cold, wet sponge to the usual method of dashing handfuls of cold water against the face, with friction. The refreshing and antifebrile effect may be enhanced in vigorous individuals with high temperatures by not drying the body until the ablution is complete. Judgment, however, must be exercised to avoid chilling and to bear in mind that reaction is aimed at.

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Another method for enhancing the antifebrile effect is the placing of wet linen towels (always without fringes, to prevent drizzling) successively over the chest, abdomen, back, and upper parts of extremities, and throwing water upon them by the hand or from a sponge, followed by friction and patting over the wet towel. This procedure approximates a bath, and often accomplishes quite as good results for reduction of temperature and refreshing effect as the full or half-bath. By modifying the temperature of the water and length of time, the antifebrile effect may be modified. After the ablution, which may be repeated once or twice, the patient is dried. It is repeated when the temperature rise again demands it. In the early stages of all febrile affections, except pulmonary and bronchial, this method will be found of value.

In chronic affections, too, the ablution is a useful preliminary to the more active hydriatic procedures. It has long been my custom, learned in treating the desperately depreciated cases presenting themselves at the Montefiore Home, many of whose patients have been utter strangers to cold water in health even, to pursue the following course: The patient receives a thorough warm, cleansing bath with soap and flesh brush. On the following day he is wrapped, nude, in two long-haired, woolen blankets. One blanket is spread on the bed, the patient laid upon it with arms outstretched, and the blanket is snugly

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wrapped around his body and between his legs. The arms are now placed alongside the body; and the second blanket is tucked around him, so that the upper corners are firmly fastened under his neck and the lower edge folded under his feet. He now lies like a mummy in the warm room, more covers being laid upon him. A glass or two of ice-water will promote the action of the skin. Having lain from half an hour to an hour, and thus accumulated heat upon the surface, his face is bathed in water from 50° to 80°, always beginning with the latter; the blankets are successively opened over his chest, abdomen, back, lower extremities, and arms, and these are successively bathed with the hand, and each part immediately dried and replaced under cover. A general dry rubbing with a woollen cloth or the hand follows, and he then is made to take some exercise, if he is able to do so. Otherwise, he remains in bed, and receives a cup of warm liquid food. This application is best made in the early morning hours, but may be made at any time, and repeated as the reactive power demands, for several days.

The next step in the hydriatic education of the patient is a *general ablution.* The patient stands in twelve inches of water at 95° to 100°, and is rapidly washed down with the hands, having water at 50° to 80° poured upon him with the hand or from a vessel, followed by gentle friction. Lower the temperature each day, according to the development of the pa-

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tient's reactive condition. This simplification of the methods adopted by special hydrotherapists, like Fleury, Winternitz, and Duval, has served me so well that I must insist on its value. I might give numerous observations on the subject, cases in which all the most valued medicinal and hygienic measures have failed, until this simple auxiliary was added and changed the entire aspect of the case. Even in poor servant girls, in whom anæmia and chlorosis are so common, who are sometimes brought to me by their sympathetic mistresses, with ashen faces, cardiac bruits, glassy eyes, etc, an astonishing change has been wrought by simply adding cold ablutions to the iron or other medication. It will not suffice, however, to tell an anæmic girl: "You must bathe in cold water every day." The importance of the shock from the brief impact of cold water must be impressed upon them, and the physician should prescribe the temperature of the water and the method of using it, as he would medicine. In the early summer months, when the water is 70° to 75° F. and the air not much warmer, the shock will be slight. Ice must be added to a basinful of water, or several basinsful should be precipitated over the shoulders and body from a height, in order to compensate by the mechanical effect for the absence of temperature difference. But, aside from their therapeutic effect, ablutions are most valuable as introductory to other hydriatic procedures in acute as well as in chronic disease, inasmuch as

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they furnish a clue to the reactive power of the patient. If, for instance, the skin remains cool and pale or becomes cyanotic after ablution and friction, we are warned to proceed cautiously to more intense procedures. The reactive condition of the patient is thus disclosed in chronic disease, and, in addition to these, the extent of heat retention in acute disease is distinctly indicated.

The *rationale* of the action of ablutions may be sought in the peripheral shock and subsequent stimulus, which is refreshing, and in the dilatation of the superficial vessels by the friction, which, according to Weyrich, increases the evaporation from the skin 50 per cent., which must be of great value in fever, because, according to Leyden and others, retention of water is one of its chief elements.

Added to this effect, we have the dilatation of the superficial capillaries, as evidenced by the rosy hue of the skin following ablution with friction. We also have the deepening of the inspiration produced by the impingement of cold water upon successive parts, which improves the circulation. If the heart's action is feeble, by the improvement of tone in the peripheral circulation its work is facilitated by removing the impediment existing in the correspondingly feeble cutaneous vessels. This *vis à fronte*, due to the enhanced contractility of the vessels, diminishes the need of a strong *vis à tergo* upon the part of the heart. This explains the reason why ablutions are a

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most valuable initiatory procedure, which the feeblest subjects may bear with impunity.

THE HALF-BATH.

This procedure is much used for reduction of temperature and refreshing the system in acute febrile affections, and for its tonic, improving, reflex effect, following relaxing procedures, to be referred to later, in chronic diseases. A large tub is filled with water about twelve inches deep. The temperature of the water is adapted to each case, from 50° to 80° F. After having a wet towel wrapped around his head, the patient, if he is not too weak, seats himself in the tub, which contains water at 85° F. The attendant bathes his face, and begins at once to rub his back with the left hand, while with the right he dashes water from a small pail (like a milking-pail) with a long handle, over the shoulders of the patient. The latter at the same time rubs the front of his body with both hands. Colder water is added from vessels prepared for the purpose, until the patient's teeth chatter. The continuous renewed application of the water and the successive shocks upon the body by the moving columns of water, accompanied by friction, stimulate the peripheral nerves, dilate the superficial vessels, and these refresh the entire organism, the effect being more intense than that described under "Ablutions." Especially important is the absence of pressure from the water, which characterizes

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the full bath, and which would not encourage the dilatation of the surface vessels so much as is done by the ever-recurring changes of temperature produced by the temporary and repeated impact. Friction, too, is more readily applied when the body is not submerged. If the patient is too weak, he may lie in the bath and refrain from washing himself, or he may change from the recumbent to the sitting position, being subjected to general frictions in the former and to drenchings with the pail in the latter.

THERAPEUTIC APPLICATION OF THE HALF-BATH.

If the technique of the half-bath is thoroughly mastered, it may be utilized as the most universal hydriatic procedure we have. In cases of acute fever, without organic lesion, it may follow or take the place of the ablutions above described. The small body of water does not inspire the patient with apprehension; the gradual and even rapid lowering of the temperature of the water is scarcely perceived, because the agitation counteracts the sudden cooling, and friction promotes immediate reaction. As in most fevers, especially those of infectious origin, the rise of temperature is connected with and partly due to a spasmodic contraction of the superficial vessels, which intercepts heat-diffusion from the skin, we accomplish one of the chief indications for temperature reduction and nerve-stimulation by the dilatation of the vessels which surely follows friction after the forcible appli-

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cation of cold water. The more slowly heat is abstracted, the more enduring will be the lowering of the bodily temperature. In this half-bath we may graduate the rapidity of heat-abstraction by the proper gauging of the temperature of the water and of the frictions. But the half-bath is not so applicable for these purposes as are others to be presently mentioned. It is more as an introduction to other more effective baths that the bath here described is useful as an antifebrile measure.

In chronic diseases in which the wet pack or other procedure, to be referred to below, has produced a dilatation and relaxation of the superficial cutaneous vessels, the half-bath is a necessary adjunct for the purpose of restoring the tone of those vessels. In these cases the tub should be filled to one-fourth its depth, say ten inches, with water from 50° to 70° F., which should be actively set in motion by the hands of the patient and attendant, as directed in the opening lines describing this procedure; the duration should be from ten to twenty minutes. When the patient arises from the bath, a coarse linen sheet, previously kept in readiness, should be thrown around him, and with this he should be rapidly dried. In acute fevers the drying should be done in bed, a blanket and sheet having been previously prepared, as directed above in the case of general ablutions.

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CONDITIONS DEMANDING THE HALF-BATH.

There are certain conditions occurring in acute disease in which the half-bath is a most important adjunct. When the patient is unconscious or delirious, muttering, or otherwise; when he presents evidences of depreciated nerve force; when the superficial vessels react feebly, as manifested by more or less cyanosis, and the heart is laboring to compensate for the loss of elasticity in the capillaries, which greatly aid the propulsion of the blood in normal conditions; when the bronchi are loaded with mucus and the air vesicles clogged by hypostatic congestion, no remedy will arouse the failing power like a half-bath, properly administered. The patient may be placed or held in a semi-recumbent position in water at a temperature of 95° F., while the upper part of his body is bathed and dried with friction, with water at 45° to 60° F. The refreshing effect of such a bath, judiciously given, will never be forgotten by any one who has once witnessed it. The patients who entered this bath with muttering delirium are aroused to consciousness; the eye brightening and the countenance losing its apathetic appearance. Others, whose respirations were shallow before the bath, breathe deeply, cough and expectorate freely, and return to bed with lungs freed from threatening hypostasis. In others, again, whose cyanotic or marbled skin indicated heart failure, the surface becomes ruddier, a more active cutaneous circulation ensues, and the pulse gains in

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force and diminishes in frequency. The reflex effect upon the vagus deepens the inspiration, a fresh supply of oxygen is carried to the feebly expanding lung, the heart is aroused, and hypostatic embarrassment is overcome. The whole aspect of the case is changed by the brief application of cold to the surface, followed by rapid drying. Now, stimulants act more efficiently, their effect being more enduring. The testimony of that experienced clinician, Winternitz, which has been confirmed repeatedly, should be borne in mind, when the terrible collapse menaces life. "Collapse," says he, "is almost universally regarded as a counter-indication to every application of cold. I would again express the opinion that I know no more powerful or effective agent for combating threatening or existing collapse than the intense and intelligently applied excitation by cold. How often have I seen, in advanced fever processes, in degenerated typhoids, a rapidly favorable change wrought in the corpse-like coldness of the extremities in the most serious manifestations of nerve adynamia, in the hypostatic congestion of lungs, by one dipping into a very cold bath, or one cold application. I am firmly convinced that very often these manifestations are not due to heart feebleness, but to a collapse of the vessels, and here an evanescent but energetic excitation by cold is the only reliable remedy, as I have repeatedly proved." Henoch (D. Med. Ztg., Sept. 1, '90) speaks highly of cold as a stimulant in collapse

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of children's maladies. He advises a warm half-bath (91° F.), with cold affusion over the neck and chest.

AFFUSION.

Affusion is the procedure by which the patient, sitting or standing in an empty tub, or lying upon a rubber cot, receives a stream of water issuing from a bucket or pitcher, preferably the former, because the stream may be broader. According to the height from which the water is poured, and the low temperature (45° to 60°) will be the stimulating effect. In feeble patients it is well to begin with higher temperatures and short distances. The action of these brief impingements of water (the head being usually omitted and wrapped in a wet towel) is the same as explained above. It is more energetic, however, because of more brief duration. *Therapeutic indications* are offered by conditions of coma, stuporous delirium, indicating adynamia and nerve prostration. It is this method by which Currie made his remarkable cures in typhus fever, using chiefly sea-water on board the ship. In *scarlatina*, when the system is overwhelmed by the poison, the circulation embarrassed, the skin pale or marbled or cyanotic, the respiration shallow, temperature high, pulse rapid and feeble, truly marvelous results may be obtained by the judicious brief use of affusions. Reaction occurs rapidly, and with it come an improved peripheral and general circulation, deepened inspiration, bright coun-

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tenance, and roseate skin. Let not the fear of cold deter any one from resorting to cold affusions, 70° to 60° F., in these desperate cases.

IN PULMONARY AFFECTIONS.

Professor Hoffmann, of Leipsic (Allgem. Therapie), says: "The greatest benefit has been obtained from the use of cold rubbings and douches in diseases of the lungs. No injurious results have ensued from their intelligent application. It is well known how cold affusions over the chest and neck produce quite peculiarly energetic inspiratory movements. Hence they have long been used to deepen the breathing in somnolent patients. Fever patients, who respire superficially and thus favor the production of hypostasis, may be thus protected against a dangerous complication. An effect upon the deep respiration is here evidenced, which furthers the circulation from the right to the left heart, and which results in a dilatation of the cutaneous vessels and in a proportional anæmia of the inner organs."

THE SHEET BATH.

To Priessnitz we are indebted for this practical and ingenious method of applying water to patients who, by reason of feebleness in acute disease, are unable to accept other more heroic methods, or in chronic disease to accept it as a means of refreshing the nervous system, which serves the purpose almost as well

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Application of the Sheet Bath (Dripping Sheet) standing —first stage. (Preller).

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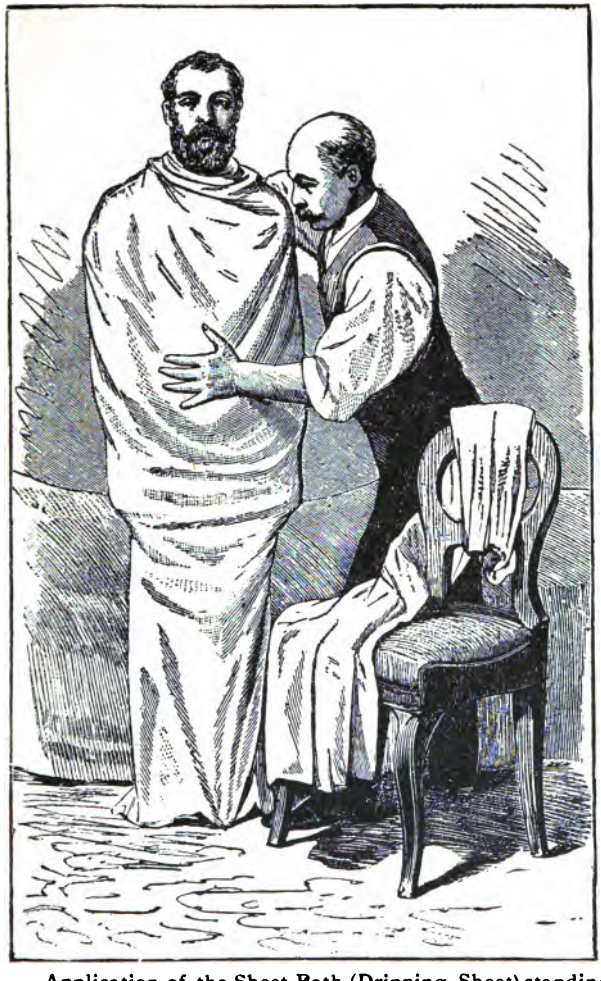

Application of the Sheet Bath (Dripping Sheet) standing —second stage.

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as the more frequently used douches of the French school.

The sheet bath is applied as follows: A rubber sheet is laid upon the bed, and several linen sheets, coarse or fine, according to the effect required, are placed in readiness. One of the sheets is now dipped into water from 50° to 80°, according to effect desired, and more or less wrung out, never so completely as for the wet pack, however, which will be described later. The sheet is laid upon the rubber cloth; the head and face of the patient having been bathed with ice-water and a wet cloth placed upon his head, he is now laid upon the wet sheet, and is wrapped with it as follows: While he holds both arms up, the right one-third of the sheet is wrapped snugly, but not tightly, around the body, bringing the upper edge over close under the left axilla and the lower along the left thigh. The left arm is now brought down, and that portion of the sheet beneath the latter brought over the body in front, carried over the right shoulder and the upper edge, and tucked in around the neck. The entire left edge being snugly tucked in beneath the right side of the body, care should be taken that a fold be placed between the extremities, or that no parts of the body lie in apposition. The arms may in feeble patients be left out altogether, and simply bathed during the process. The first impression will be a shock to the peripheral nerves. This is readily overcome by the patient's

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own temperature, and its removal is aided by the manipulations of the bath nurse, who, with outstretched hands gently and gradually sweeping over the wet sheet, passes over the entire body successively. So soon as any part of the body becomes thoroughly warmed again, water from 50° to 60°, according to condition of patient, is poured from a cup or squeezed from a sponge over them. These gentle passes or frictions are alternated with the pouring on of small quantities of cold water, until the body feels cooled or the patient shivers a good deal. Rigor must always be avoided, because it is an evidence of contraction of the vessels, and of a too decided temperature difference between the central and peripheral portions of the body. As the friction prevents this objectionable feature of all cold baths and enables us by the renewed application of cold water upon the warm parts of the sheet to maintain the cooling effect, we have in the sheet bath an admirable antipyretic, whose effect may be greatly enhanced by allowing the patient to remain in it, withdrawing the rubber sheet and wrapping him in a blanket, for half an hour. Its mildness as compared with the full cold baths renders it more acceptable to the patient and his friends, and it may thus be utilized as a valuable initiatory antipyretic measure, intermediate between the ablution and the half-bath, which have been discussed. It is applicable in all acute diseases, in which an elevated temperature is a leading manifestation, and it may

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form a substitute for the full bath in some of them where the necessary apparatus for the latter cannot be procured. For instance, in the country, where bath-tubs are not obtainable, linen sheets, or at least linen tablecloths (or even old and well-worn cotton sheets), a piece of oilcloth, a blanket, or bagging to protect the bed, a bucket of water, and sponge are all that are needed. By using a sofa or lounge for administering the sheet-bath, or placing patient on the floor, it may be given with an abundance of water from the sponge or a pitcher, the superfluous heated water being kept from overflowing by the careful absorption with the sponge. It should always be remembered that there is no danger of the patient, with a temperature of 103° and over, taking cold. This bugbear often prejudices the physician, as well as the patient, against all hydriatic measures.

To enhance the antipyretic and soothing effect, the patient may be covered up in the wet sheet for half an hour. The *antipyretic action of the sheet bath* may be explained as follows: The immediate effect upon the peripheral vessels is to contract them, and drive the blood from the cutaneous surface toward the interior. For this reason a wet bandage and occasional affusions upon the head are necessary to prevent retrostasis with determination of blood to the head. Since, however, the shock to the sensory nerves is brief, and no sooner is conveyed to the nerve centers than it is reflected by the motor tracts,

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the local action is really evanescent. The sheet rapidly warms up, if the patient's temperature is above 102°. The addition of cold water upon the warmest parts of the sheet abstracts heat from the vessels which have been dilated by the frictions referred to. In this manner there is a gradual cooling off and reheating of the sheet, which is conveyed from and to the parts beneath it. Each time the cold water impinges upon the sheet, a deepened inspiration ensues, which furnishes more oxygen. The dilatation of the peripheral vessels removes the previously existing abnormal resistance to the blood pressure, and thus gives the heart freer action, reducing the pulse rate, and, if the patient be allowed to rest in the wet sheet, a calm sleep ensues. A rational antipyretic effect is thus inaugurated, which does not fatigue the patient so much as the full bath.

THE SHEET BATH IN CHRONIC DISEASE.

But not only in acute disease is this method applicable. In all chronic affections, accompanied by some elevation of temperature, it is a useful adjunct, and in many cases an important element in the treatment. In the first and second stages of phthisis, for instance, V. Ziemssen has said of it (Ætiology and Therapeusis of Tuberculosis, Geo. S. Davis, p. 88): "I cannot conclude the chapter without referring to hydrotherapy, which occupies a very important position, both for the prevention and for the cure of tuber-

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culosis." He then describes a modification of the sheet bath for hardening the body: "The sheet should be wrung out of luke-warm water first, and later colder water may be used. The practice drives the vaso-motor nerves of the peripheral arteries to prompt reaction. It acts centripetally as a thermo-irritant to the nervous system, stimulating and refreshing it, and indirectly on the innervation and functions of the respiratory, circulatory, and digestive system. At first water at about 86° F. is to be used, and the cloth should be well wrung out. On each succeeding morning the temperature of the water may be reduced 1⅛° F. It is important that the cloth should be well wrung out, the aim being to produce a thermic and mechanical irritation of the superficial vessels and nerves, not to deprive the body of any considerable heat. The latter effect would be produced if the cloths were saturated with cold water. To attain the desired end, very low temperatures are not needed, and it is seldom necessary to go below 66° F. Such friction baths can be used in private practice everywhere and among the poorest people. Unless the patient is very weak, I do not permit him to return to bed after rubbing. It would be much better if he would at once take some outdoor exercise, if the weather permit, and return after an hour to his breakfast." Local frictions with cognac are not approved of by V. Ziemssen. He says correctly: "They miss the essential thing; that is, the sort of

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shock which is produced by wrapping the body in a wet cloth or sheet, and which inures the surface to the sudden cold or dampness, and produces prompt action of the superficial vessels and hardens the sensitive nerves. Should a more thorough treatment be desirable, the patient should be sent to a water-cure establishment." In the Montefiore Home, where, as has been mentioned, the most depreciated cases of phthisis are received in all stages, the treatment is begun, as above stated, by ablutions; and these are followed by the daily sheet bath, as follows (the large increase of patients has led me to adopt the rain-bath recently): The temperature of the room is not below 68° F.; the patient stands in a foot-tub containing twelve inches of water at 100° F.; a sheet dipped into water at 70°—daily or less frequently reduced until it reaches 60°—is thrown dripping over his head and back. While he rubs himself vigorously in front, the attendant makes rapid passes over the sheet up and down the back, sides, and lower extremities with the outstretched hand, occasionally pouring a basin of water, 10° to 15° below that of the sheet water, over the head and shoulders. This is alternated with frictions from five to ten minutes. The sheet is now rapidly withdrawn. In most cases, especially after the treatment has been pursued for some time, the skin becomes decidedly hyperæmic. Friction with a dry sheet or towel increases the cutaneous suffusion, and the patient emerges from this bath greatly

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refreshed, and goes out to walk in good weather. The situation of the sheet is governed by the presence of elevated temperatures.

There are many chronic ailments to which the wet sheet is applicable, especially as a substitute for the douche.

The flexibility and simplicity of the method commend it especially. It is probably the most flexible hydriatic measure known. By wringing the sheet well out, or in using a coarser sheet or a lower temperature, or for a short time, or by slapping with, instead of simply pressing, the hand over the wet sheet, the local excitation of the cutaneous nerves and vessels will be enhanced. By saturating it with more water, the antipyretic effect is increased, which may be still more intensified by more prolonged application and frequent addition of colder water, or by a finer texture of the sheet. The duration of the sheet bath is matter for the most careful discrimination. *Two to five minutes* suffice in most cases for the tonic effect, while for the antipyretic effect fifteen to twenty minutes may be necessary. It is, of course, understood that the excessive sensitiveness of the skin in the presence of cutaneous diseases or inflamed surface precludes the use of the sheet-bath entirely. In the care necessary in adapting the sheet-bath and other hydriatic procedures to various conditions must be sought the reason why the best informed medical men in France and Germany send their chronic cases,

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which have resisted simple measures, to colleagues who have made a special study of hydrotherapy, and consign them to their treatment entirely. A large experience enables these gentlemen to adapt, by infinite variations, seemingly slight to the uninitiated, certain modifications which promote recovery after less intelligently applied hydriatic measures have sometimes failed. I do not desire to be understood, however, that the general practitioner is not perfectly competent to treat such cases hydriatically. On the contrary, it is the aim of this work to lend him such assistance as may enable him to treat his patients at home, and to discover the limitations of home treatment, for many cases are needlessly sent away from home to a water-cure establishment, in which water is anything but scientifically applied.

THE WET PACK.

This procedure has been found extremely useful in acute and chronic diseases. It has been long established, but it is not, as is commonly supposed, an invention of Priessnitz, for it was first recommended by Lucas, an English physician, in 1750. Doubtless Priessnitz discovered it, independently, for he was too unlettered to have been aware of Lucas's practice.

Like all other hydriatic measures, it requires great care and nicety in its application, if the results are to be adequate. The dread of a damp sheet is so intimately associated in the minds of the lay people

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Wet Pack.—First Stage.

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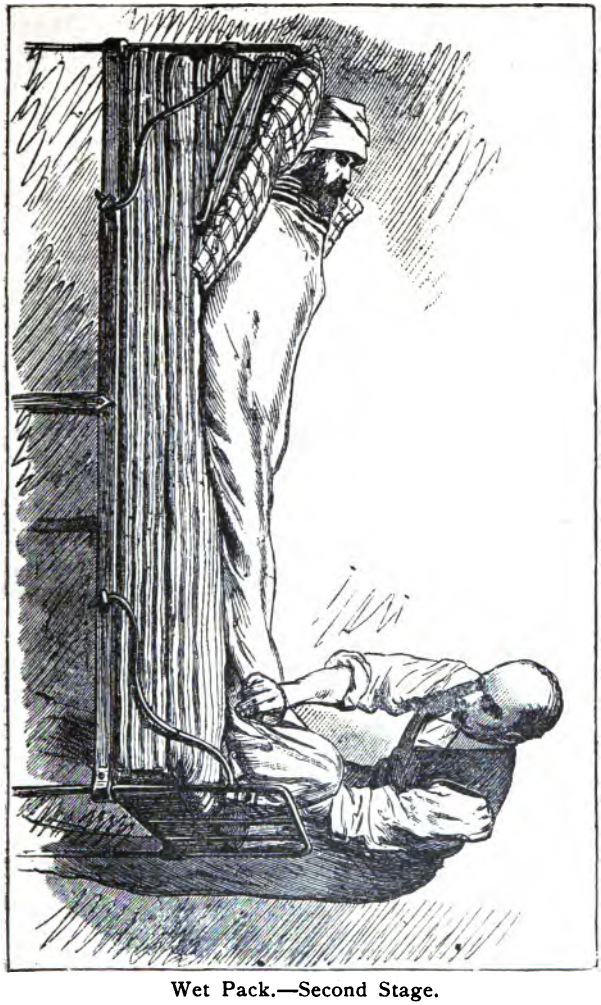

Wet Pack.—Second Stage.

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Wet Pack.—Third Stage.

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with rheumatism and colds that the very name brings a shudder to the patient to whom it is novel, while, on the other hand, persons who are familiar with it abuse it by too frequent resort.

The technique is as follows: A large woolen blanket is spread upon a hair mattress, most appropriately placed (if a wire mattress is used, a rubber sheet must intervene to protect it from the moisture) upon a high four-legged cot. Upon this is spread smoothly a linen sheet, *well wrung out* of water of temperature from 50° to 70°, appropriate to the case; the blanket should be long enough to extend two feet or more beyond the patient's extremities. The patient, with a wet cap upon his head, places himself upon the sheet, with his arms alongside but somewhat separated from the body, so that he occupies its middle. The sheet is now rapidly folded upon him in such a manner that folds of it are pressed alongside and separate the arms from the body, and are also placed between the legs. It is snugly secured around the neck and beyond the feet. The sheet should lie closely upon the chest, but must not embarrass respiration. The blanket is now drawn firmly from the left, and tucked under the right side of the body, the right border of the blanket being drawn over to the left in the same manner, firmly securing it under the body and around the neck, and folding it over the feet. *Everything depends upon complete exclusion of air from the blanket cover.* The patient is now

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covered with more woolen blankets, if necessary. If the covering has been skillfully done, the patient will resemble a mummy, whose head is enveloped in a wet turban.

Modification of this procedure consists in half packs, in which smaller or larger parts of the body are enveloped in the damp sheet. The duration of the pack (which should be from one-half hour to an hour), the texture of the sheet, the temperature of the water and extent of pack, as well as the repetitions, modify the effect materially, as will be seen. All wet packs must be followed by some hydriatic method which restores tone to the cutaneous vessels which have been relaxed by it. Either a half-bath, a sheet bath, or a cold ablution will serve the end, and these are selected with regard to the need of each separate case. One important element of the wet pack is the complete ventilation of the room during the time the patient lies in it, for reasons referred to below.

RATIONALE OF THE PACK.

The first effect of contact with the cold damp sheet is an irritation to the cutaneous nerves, which induces contraction of the peripheral vessels, and which continues until the individual's power of reaction comes into play. This depends, as in all hydriatic procedures, upon the age and condition of the patient; old people and children do not react as readily as adults, and a previous high temperature of

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the skin furthers rapid reaction, as does also a vigorous normal circulation. There being no mechanical aid given by the attendants, as in the sheet bath or half-bath, reaction depends entirely upon the vital powers of the patient. This fact distinguishes the wet pack completely from all other hydriatic procedures, and demands judicious recognition of the patient's reactive capacity. As soon as the first shock is over, which lasts from five to twenty minutes and sometimes produces shivering, the peripheral vessels begin to dilate, and the system makes an effort to equalize the temperature between the skin and the sheet. When the body temperature is high, as in fevers, there is no chilliness, the cooled blood is driven from the surface to the subjacent structures, but very soon the warm blood from the interior takes its place, and dilatation of the vessels is the result. This continuous interchange of temperature, which occurs easily and slowly in patients with normal temperature, gives rise to a vaporization from the sheet which, in fever, furthers loss of heat from the skin. This is increased by radiation from the blanket, and by the state of rest in which the patient is placed and consequent formation of a vapor which envelops the entire body and cannot escape it. This continues as long as the sheet remains cool and just so long the thermic irritation is renewed, more feebly each time, until the sheet is thoroughly warmed.

Max Schüller demonstrated the action of the

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wet pack upon trephined rabbits. He wrapped them in a sheet wet with water at 34°, and covered them with wax-cloth and woolen blankets, snugly tied up, so as to leave the head only free, and laid them for two or three hours upon the table. The temperature sank one or two degrees, but began to rise again in 2¼ hours. The respirations became more slow and deep, and the pulse less frequent. The animals reacted less to irritants, and seemed to be drowsy at first, but with the rise of temperature they became more lively, and began to kick actively.

A striking effect upon the vessels of the pia mater was noted. After a rapid dilatation the vessels became narrower, the brain sank in more and more, and the dura mater was raised up by the cerebro-spinal fluid, which accumulated abundantly underneath it. The cerebral movements became more slow and more equable. This lasted several hours. External irritants, pinching, rubbing, or lifting the animals, produced at first rapid, but afterwards more short, cerebral movements and greater, but changeable, dilatation of the vessels. As soon as the pack was removed, dilatation of the vessels occurred, but they soon resumed their normal calibre. Respiration and cerebral movement became more frequent; warm compresses upon the belly and back of the animal produced a contraction of the vessels of the pia, with acceleration of pulse and respiratory movements; the former became less perceptible, the latter more

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shallow. These experiments render the action of the wet pack upon the human body intelligible. We often find the patient slumbering as soon as the temperature is equalized between the body and the sheet, and warmth is evolved by the reactive process.

If abstraction of heat is the chief aim, the temperature of the sheet should be 55° to 65° for the first pack; the patient must be removed from the pack when the latter is warm, and placed in another two degrees higher, which has been prepared on the same or on an adjoining bed. He is again removed into another of two degrees higher as soon as he warms the sheet and superincumbent blanket, which is ascertained by applying the hand to various parts. Liebermeister has shown that five such wet packs of ten minutes' duration will abstract as much heat as one full bath at 65° F. for fifteen minutes. When the temperature, therefore, is high (above 102°), or when insurmountable objection is made to other more or less heroic measures, the wet pack is a useful and acceptable alternative. It may be for the physician to decide whether he would prefer administering five packs, consuming fifty minutes' time, to a full bath of fifteen minutes. The character of the case will aid him in this decision. My own experience is in favor of the full bath, if the ablution and sheet bath and half-bath have proved insufficient, and the proper help and tubs can be obtained. For mild cases, however, with temperature of 100° to 103°, especially cases of non-infectious

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type, the pack is an admirable anti-febrile remedy. As it may be modified by repetition of sheets wrung out of water of higher temperature, each of longer duration, if the body continues to cool, or by lowering the temperature of the damp sheet, if the body temperature does not fall, we possess in the pack a most flexible remedy, subject to accurate dosage, as it were. Thus, in fevers, the first impression of cold upon the surface will cease abruptly and give way to the first-mentioned process of evaporization. This produces a soothing effect upon the peripheral vessels and nerves, and often produces sleep in patients who have been tossing restlessly before.

If this calming effect be the chief indication at that period of the disease, the patient having lost sleep or being on the verge of delirium, it would be wise to permit him to remain in the pack until he awakens, and then give him a cold ablution. If, however, the high temperature or depreciated nerve tone—adynamia—be the therapeutic indication, the patient should be removed from the pack as soon as the blanket or sheet beneath begins to feel warm. He should now be placed into another pack, as directed above, the process being repeated until four or five packs have been given, or the temperature has been sufficiently reduced, precaution always being observed to permit him to remain in the last pack, which cools, but does not chill him rapidly for ten or fifteen minutes. If not too much fatigued, a rapid

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ablution with water from 50° to 60° should be administered before he is again dressed. This method is slower, but its effect is more enduring than the more rapid cooling by the full bath, for the reason that the compensating elevation, which is the normal conservative reaction, is more deliberate and tardy.

RATIONALE IN CHRONIC DISEASE.

If the body temperature is normal, or a little above normal, as is the case in most chronic diseases, the thermic irritation is the same as in acute disease, but the response to it is quite different, owing to the usually depreciated nerve tone and diminished reactive power. The peripheral vessels are contracted, the patient probably shivers longer, because the surface is not so rapidly supplied with fresh blood and the latter is more readily cooled. In extreme youth and age the power of reaction to the thermic irritation is diminished. This also depends upon the more or less vigorous condition of the patient, and, to a certain extent, upon his temperature. The cooling effect lasts ten minutes or longer, during which time the patient feels somewhat uncomfortable, and often begs to be removed from the pack. The first impact of cold upon the surface, too, often produces gasping respiration, and enhances the discomforts experienced. These, however, pass away more or less quickly. The equalization between the body temperature and that of the damp sheet and the vaporization from the latter

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envelop the body in a vapor of its own creation. The reactive labor thus involved is of great benefit to the circulation, and it has been demonstrated to aid in enhancing tissue metamorphosis. The patient, lying quietly in the pack, often falls asleep. Indeed, I have seen, at Prof. Winternitz's institution at Kaltenleutgeben, numbers of patients soundly sleeping, although the packs are usually given before 7 A.M., i.e., just after rising from bed. The calmative effect of an hour's sleep in a gentle poultice, as it were, is valuable in functional neuroses, hysteria, and some heart troubles.

In an able monograph on The Wet Pack and Massage, which is the only scientific contribution to hydrotherapy in this country, Dr. Mary Putnam Jacobi furnishes so intelligent and comprehensive an explanation of the wet pack that I reproduce it in testimony of my appreciation of this isolated contribution:

The increased production of heat, determined by the stimulation of the heart-regulating apparatus, irrespective of the amount of heat abstracted by the cold, involves functional activity (1) in the sensitive afferent nerves; (2) in one or more parts of the nerve centres; (3) in centrifugal nerve fibres of some kind terminating in muscles; (4) in the muscles where are performed the chemical processes involved in the production of excess of heat. Thus the organism is induced to perform a definite and not inconsiderable amount of work. On this account its nervo-muscular tissues, or a large portion of them, are brought into a

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condition favorable to nutritive assimilation. But this is not all. When the reaction after the cold pack is normal, the column of blood which sets inward toward the chylopoëtic viscera very soon turns outward again, accelerating the entire circulation of these organs in the same direction. As a most important result, more nutriment is carried into the general circulation, and with the abatement of the gastro-intestinal hyperæmia the appetite revives.

Sleepiness during the pack nearly always occurs in successful cases, and we have found the greatest benefit to accrue when the patient was able to sleep for half an hour after the completion of the pack and massage. If, during the first period of the pack, we may assume, for reasons already stated, that blood circulates in increased volume and under increased pressure through the nerve centres, and that, in consequence, the acid fatigue products, which had been maintaining a permanent excitement of nerve elements, could be completely removed, the immediately subsequent diminution of blood supply, effected during the second part of the pack, cannot fail to be a great advantage, for it lowers the functional activity of the the nerve tissues that has been unduly prolonged, and brings them, therefore, into the condition which is a necessary preliminary to the beginning of nutritive assimilation. The diminution of blood supply is not sufficient to interfere with this latter process, for it is not below the point which exists in sleep, the physiological period of the nutritive assimilation in nervo-muscular tissues. Accepting Ranke's law for these tissues, that they are only nourished when fatigued—i. e., relaxed—we may see, further, in the muscular relaxation induced by the warm moisture of the pack, a condition most favorable for the nutrition of muscles."

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The therapeutic application of the wet pack is extensive, being valuable in all chronic cases in which defective tissue metamorphosis is a prominent element, as in *diabetes*, *rheumatism*, *gout*, some disorders of the digestive apparatus, *anæmia*, and *chlorosis*. In functional neuroses the wet pack offers a means of allaying irritability, and, if succeeded, as it should be, by a half-bath, douche, or other active mechanico-hydriatic procedure, it will refresh the nervous system, improve tissue change and the blood-making function, and invigorate the circulation. Thus, a combination of effects results which no other procedure is capable of furnishing.

In cardiac troubles I have found it of great value. I have now a gentleman of 65 under treatment for chronic valvular disease (mitral and aortic), with failing compensation, who has been entirely freed from a diabetes of fifteen years' standing (the case will again be referred to). It was with the greatest difficulty that I have been able to steady the heart with spartein, digitalis, etc. Being previously prepared by ablutions, he reacts well in a pack of 65°, followed by ablutions of 60°, the pulse becoming steady and being reduced in frequency. The effect is doubtless due to the removal of impediment to the cardiac systole, which the large area of dilated cutaneous vessels produces in a subject susffering from artheromatous degenerations of the vessels.

In another case of functional cardiac trouble,

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Mr. C., sent me by Dr. B. W. Taylor, of Columbia, S. C., the effect of this treatment is palpably evident in the subjoined sphygmograms:

The improved tension and increased force of the pulse are as evident as is the diminution of the pulse rate, which was taken immediately after entering my office, to which he walked two and a half blocks from the station. This patient had been taking digitalis for a long time without effect.

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CHAPTER II.

THE TUB BATH.

This is the so-called full bath of the Germans, by American physicians briefly termed "tubbing." It is the most complete method of bathing resorted to, consisting of an entire submersion of the body, with the exception of the head, the chin barely touching the upper surface of the water. As this procedure has been applied with notable success in the treatment of typhoid fever and other infectious diseases, a detailed description of the method and *rationale* demands attention.

The *technique* of this bath varies with the therapeutic object we have in view, as will be shown. The cold tub bath is applied as follows: A tub of sufficient length and breadth to comfortably accommodate the patient, and filled to three-fourths of its depth with water from 80 to 65° F., is placed near the patient's bed in acute cases, separated by a screen, which prevents his being excited by the preparations. A double blanket is spread upon the side of the bed to be occupied by the patient when he has finished the bath, the pillow being covered by a towel. Upon the blanket is spread an old linen sheet (cotton is worthless, because it does not absorb water readily, and it is sometimes necessary, as will be shown, to let the patient remain in it without drying). Several hot

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water bags or bottles are also prepared for the feet, which are usually cold after the bath. The patient now receives a stimulant. He is undressed, and a light napkin is applied to cover the sexual organs. His face is now bathed with ice-water, and, if too feeble to step into the bath, he is lifted into it by two assistants. With the greatest gentleness and least fuss he is lowered into the water. He gasps and shudders a moment, or perhaps cries out. But gentle reassurance by word and deed, a calm demeanor, devoid of haste, and the absence of all actual force or argument to resist his natural desire to escape from the seemingly heroic treatment, will not fail to quiet his apprehensions. Friends or relatives must be kept out of the room, as their presence would increase the anxiety of the patient, and render him more resisting by injudicious and unavailing explanations. If an air cushion has been suspended over the head of the tub, it will afford a good resting place for the patient's head, and a large water cushion ring makes a comfortable support for his nates. In the absence of a head support, the nurse will hold it up with the left hand, while with the right gentle friction or chafing will be practiced over successive parts of the body. This may be done also by an assistant, who in private practice may be a member of the family or a friend. Care must be taken that every part of the body (except the lower part of the abdomen) receives the benefit of these frictions, *which are regarded as of supreme*

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importance by the originator of this method in preventing chilling, collapse, cyanosis, and heart-failure. The effect of the continuous gentle chafing is a suffused redness, which is in marked contrast to the previous death-like pallor of the surface, and demonstrates that the calibre of the superficial vessels is considerably enlarged. As this is being done in successive parts of the body, we really manage to maintain a constant contraction and dilation of the peripheral vessels, the former being accomplished by the contact with the cold water in motion, the latter by the friction and its attendant reaction. Complaints of chilliness must not be regarded as an indication for removal of the patient from the bath, unless it be accompanied by decided chattering of the teeth; the former is voluntary and may be emotional, the latter is involuntary. A small pulse, a cyanotic or shriveled condition of the extremities, too, are regarded by the inexperienced as a warning signal to remove the patient from the bath. These symptoms may be due, it should be remembered, to the local action of the cold upon the superficial vessels, and need not be regarded as threatening unless the *face* becomes cyanotic. This, not being submerged, can only be rendered cyanotic by actual enfeeblement of the heart action, a condition which is exceedingly rare when the bath is administered *with friction.* That the small pulse is not an indication of heart-failure will be evident to the re-

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flecting observer from the fact that it is much slower and less compressible, having lost its dicrotic character. For this reason bystanders, who may be easily alarmed, must be avoided, or, if their presence and assistance be needed, the true explanation of these symptoms should be given them ere they occur. The duration of the cold full bath depends upon the object in view, which will be treated under the proper heads. Several times during the bath, which usually lasts fifteen minutes, a basin of water at 50° F. is gently poured over the patient's head, around which a handkerchief folded like a bandage, two inches wide, is tied in a knot over the nucha. This forms a gutter, and prevents the surprise produced by cold water flowing over the face. If the patient is somnolent or delirious, cold water is poured over head and shoulders. The bath being finished, the patient is gently lifted out, the napkin covering the sexual organs rapidly dropped, and he is placed upon the previously prepared linen sheets, so that the upper edge extends above his shoulders to the nucha. He is now carefully wrapped as follows:

Being laid upon the sheet so that his nucha touches its upper edge, the sheet is brought around the body, a fold being pressed in between the arms and the body and between the lower extremities, the object being to prevent the approximation of wet body surfaces. The blanket is now wrapped around the patient. If the temperature has been high, above

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103° in the rectum, the patient is allowed to lie in the sheet for five or ten minutes; if the temperature is lower, he should be at once dried with the sheet and afterwards with soft towels. In either case hot bottles are placed to the feet. Usually the patient who has been restless previous to the bath will fall asleep.

This is the ideal bath designed by Ernest Brand, of Stettin, for the treatment of typhoid fever, to which we shall have occasion to devote much attention. The technique has been rather minutely described because the author has seen it so frequently applied *without friction*, and otherwise improperly, and its success as a therapeutic measure depends upon its exact execution.

Another full bath that has received much well-deserved praise from clinical observers is the graduated bath, devised by Von Ziemssen, of Munich. This procedure is executed as follows: The preparation for bathing and drying the patient is the same as in the Brand bath. Water at 90° to 86° F. is poured into the tub until it is about one-third full. The patient being placed in it, the attendant bathes the body with the hand and sponge, while another attendant adds water at about 40°, at points where it does not come in immediate contact with the body, until the temperature of the water reaches 77° to 72° F. It will be necessary usually to remove some of the water from the tub by a faucet or pitcher while

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colder water is added. *Chafing is here also an all-important element of the bath.* The only difference is that a gradual accustoming to the cold water seems less heroic to the patient and his friends, and the bath may be prolonged to half an hour. Indeed, this is the time required by Ziemssen for this bath. When it is finished, the patient is wrapped in a previously warmed woolen blanket without being dried, for a quarter of an hour, and then dried, and his clothing replaced.

The *rationale* of these cold full baths, which have been chiefly applied in typhoid and other infectious fevers, is so exact and scientific that it must lend firmness born of conviction to the attendant who applies them with a clear understanding of their aims and capabilities.

What are the indications for treatment in a case of typhoid fever, for instance? Here we have an infective process due to some cause which is beyond our control, which manifests itself by the following conditions, against which we must do battle if we would rescue our patient from its grasp:

1st. The nervous system manifests, almost from the beginning, decided and serious depreciation, due doubtless to the specific infective agent. An indefinable malaise is followed by ataxia, general lassitude, somnolence, and other adynamic manifestations, which culminate in stupor, delirium, and coma, subsultus, tremor, etc.

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2d. The heart, being called upon to do extra duty, threatens to fail, and often does fail, not owing to the elevated temperature only, but to a paralytic condition of the capillary circulation, induced by the infective process, which embarrasses the peripheral vessels.

3d. An elevated temperature renders the patient uncomfortable, deprives him of sleep, impairs his organic functions; all of which difficulties, if prolonged without remissions, will sooner or later lead to serious, if not fatal, results.

1. We place the effect upon the nervous system above all others. Though gradual and insidious in the beginning, the manifestations arising from a depreciation of the nerve centers never escape the experienced observer; indeed, they are the most uniform characteristics of typhoid and infective fevers. Only one observation will be quoted in support of this view. Dr. Edward Delafield says, in a paper on typhoid fever, read before the Academy of Medicine, and published in the Medical Record, Nov. 12, 1883, in referring to the reliability of symptoms in the diagnosis: "A study of all the temperature curves shows that we must not expect too close a correspondence with the schematic curve." In contrast with the unreliability of other symptoms, he mentions that "the appearance of the patients was characteristic. A dull, apathetic expression, the skin of the face dusky colored, the cheeks often bluish, the mind dull and slug-

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gish, all the conditions were well marked. In only one case were these symptoms notably absent." These symptoms are the expression of a depreciated condition of the nerve centres, which in typhoid and similar fevers is the leading point of attack, and must, therefore, be the leading point of defense. From it originates a condition of the circulation which, by its effect upon the peripheral vessels, not only disturbs heat radiation, and thus develops temperature elevation, but later in the disease gives rise to other most threatening conditions, failure of the heart, local hypostases, bedsores, etc.

2. That the elevation of temperature is not due to the fact that heat radiation alone is interfered with has long been held. Even Galen suspected that a spasmodic condition of the blood vessels supplying the skin may be the cause of fever, by retention of heat in the body. Cullen and the physiologist Henle held similar views. But it remained for the great clinical teacher, Traube, to demonstrate that the rise of temperature is the direct result of the contraction of the peripheral vessels, by showing that a chill, with its consequent cutis anserina, is always accompanied by a rise of temperature. But, as the rise sometimes precedes the chill, this doctrine proved defective, until Maragliano demonstrated by means of Mosso's pletysmograph, which shows with the greatest precision the slightest change in the volume of any part, that the blood-vessels begin to become narrower in

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the stage of invasion of fever, before a rise of temperature may be recognized, that as this vascular contraction continues, the temperature begins to rise, and that chill ensues after both had continued for some time. He also showed that, the maximum rise of temperature coincides with the maximum contraction of the blood-vessels. The proving of this proposition is made complete by the observation of Bettelheim in Von Basch's laboratory, and confirmed by Geigel, that the reduction of temperature produced by antipyretics is always accompanied by dilatation of the cutaneous vessels, which increases heat loss, and that a new exacerbation always is initiated by a renewed contraction of the peripheral vessels.

This view has been always persistently advocated by Winternitz, even when Pflüger, Zuntz, and other men of eminence opposed it and sought to overthrow it. Liebermeister, for instance, attempted to show that heat regulation was chiefly induced by heat formation, citing as plausible evidence of his proposition that his chemical examination had clearly proved that, whenever heat elimination was obstructed from the surface of the body, there was noted a proportionally increased elimination of CO_2, which was sufficient to maintain the temperature equilibrium, if the heat abstractions were not excessive, but was not able to prevent the lowering of the body temperature, if it were excessive. This physiological fact, established by the exact experiments of Maragliano, has

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been clinically demonstrated by Winternitz's able assistant, Dr. O. Pospischl, who showed that mechanical irritation of the skin is capable of increasing heat loss 95 per cent, as will be shown later. It is impossible, too, to account for the sudden and enormous reduction of temperature we so often observe in the crisis of diseases upon the theory of diminished heat production. The time is entirely too short in these cases for the elimination of the enormous heat accumulation. We can more easily account for it by the great increase of heat elimination which Pospischl has shown to be possible.

Moreover, the idea that the increase of CO_2 during surface heat abstraction is an evidence of an increased internal heat production is disproved by the recent experiments of Speck and Loewy in Zunz's laboratory, who demonstrated with precision that heat abstraction produces an increased CO_2 elimination only when voluntary or involuntary muscle actions are not avoided. Loewy says that his experiments on heat regulation have definitely settled that the first result of an irritation due to cold is a contraction of the skin and its vessels, which, by the restriction of moderate heat diffusion affords a complete compensation, but in intense heat abstraction only an incomplete compensation occurs. Hence, in the first case the temperature remains the same, while in the last it is lowered. Change of heat production may be added by reason of chill or muscular contrac-

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tions, due to involuntary tremor, which, however, are of far inferior importance in the heat regulation than the action of the skin. Winternitz may well point with pride to the confirmation of the theory of fever production and fever treatment which he had advocated for 25 years in opposition to some of the best pathological experimenters.

This explanation of fever genesis becomes of immense importance, not only in the question of heat elevation, but even more decidedly in its treatment. It makes the reduction of elevated temperature by the bath a strictly scientific proceeding. Rosenthal, Leyden, and Botken have clearly demonstrated that in many forms of fevers the rise of temperature may be traced as above stated to a diminution of heat dissipation from the surface, which results in actual retention and accumulation of heat in the body. These and other investigators have also shown that the evaporation from the surface is inhibited. Now both of these direct factors of temperature elevation are simply and scientifically removed by hydriatic measures. It is the chief object of the latter to improve the tone of the superficial vessels, to *actively* dilate them, and thus increase the heat dissipation, as has been again and again demonstrated by Winternitz and others; and also to increase the elimination of water from the surface.

Here we are met at once with the importance of precise attention to the method of bathing. To im-

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merse the patient in a full bath of low temperature, or to wrap him in ice sheets, as has been done in some hospitals, would result in closing the superficial vessels and keeping them closed. If such treatment does not induce collapse, reaction may slowly take place, and the former high temperature is again reached or exceeded. If, however, the patient is carefully placed in a bath of 65° to 70° F., and constant and unremitting gentle friction is practiced over the entire body, the coats of the superficial vessels are stimulated, reaction from the first shock ensues, the vessels contract rapidly and dilate actively, as the ruddy condition of the skin which has been subjected to friction testifies. This condition is maintained by an occasional basin of cold water poured over the neck and shoulders, followed by friction. The mechanical irritation not only removes the obstacle to heat dissipation, but, as Weyrich has proved by an exact experiment, it increases the elimination of water from the surface 60 per cent. Moreover, the cooled blood is sent from the dilated vessels back to the interior of the body, and thus a direct cooling effect is produced besides. The baths, therefore, when combined with friction and douching, fulfill both indications for removing high temperature, while medicinal antipyretics fulfill only the first—heat dissipation.

EFFECT UPON THE HEART.

The enfeeblement of the heart power also may be shown to be the result of loss in tone in the

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smaller vessels, which Marey and others have termed a paralysis of the muscular coats of the vessels, and later to parenchymatous degeneration due to the infective process plus high temperature. As Winternitz has so ably shown, we have here an imitation of Golz's experiment on frogs, which demonstrated that a loss of tone in the vessels of a large area of the circulation and a diminution of the tension in these vessels enfeebles notably the action of the heart. That we possess in a cold bath, combined with friction and gentle affusion, an effective agent for the restoration of the lost tone of the coats of the vessels, is proved by the exact experiments of Delmas and Winternitz, and that this effect, together with the reflex stimulus conveyed to the nerve-centres governing the heart from the peripheral cutaneous nerve-endings, refreshes and invigorates that organ, lessens the number and increases the force of its contractions, and prevents dicrotism, is positively demonstrated by tracings taken by the writer with Dudgeon's sphygmograph. In order that the tonic effect upon the heart be continuous, it is important that the bath be repeated at sufficiently frequent intervals (three hours having been ascertained as the proper average). The effect upon the heart and vessels must be watched.

In the early stages of typhoid fever, when reactive power has not been much enfeebled, chattering of teeth, facial pallor, and a small pulse ensue later than in the more advanced stages. But these must

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not deter us from continuing the bath; they demand increased friction of the surface, and perhaps a little alcoholic stimulant. If superficial hyperæmia is readily induced by the friction, a small pulse, or even a pinched countenance, does not demand removal from the bath. Only decided chilliness and prolonged chattering of teeth are indications to remove the patient, because the muscular contractions incident thereto induce, as Speck and Loewy have shown, increased oxidation, which must be avoided here.

Sphygmographic tracings I have been unable to obtain after the bath on account of trembling of the patient, but positive evidence of the improved condition of the pulse is found in the fact that while it feels small and almost thread-like, it has gained in force and tension, and continues to so gain until the good effect of the bath passes away. It becomes far less compressible and slower almost invarably. In advanced stages the effect of the cold bath is not so pronounced, because the reactive power is more in abeyance if baths have not been used in the beginning. In the third or latter part of the second week of typhoid, either higher temperature (75° to 80° F.) or more brief application of the same (65° to 70°) is indicated, always bearing in mind that the *rapid application of a low temperature is more refreshing and stimulating, though not more heat-reducing, than the prolonged application of a higher temperature.* The reverse idea, though erroneous, seems to be so well established in the lay as well

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as in the professional mind that it is difficult to dislodge it.

In the discussion of the best temperature-reducing baths known to hydrotherapy, this subject will be so clearly brought out that I trust it will demonstrate the error that *the colder the bath the greater the reduction of the temperature.* This erroneous idea has been the cause of numerous disputations between the adherents of Liebermeister and those of Winternitz. Voit, to whom we owe so much in connection with the study of the physiology of heat regulation, has demonstrated that an increased tissue metamorphosis does follow the application of cold, amounting to as much as 40 per cent., but that no rise of temperature can be produced in this way if we do not have a simultaneous disturbance of that greatest heat-regulating organ, the skin. If a patient with 104° F. is placed into a bath of 65° F., and allowed to remain there until he shivers, the skin becomes more contracted, and thus heat-elimination is really prevented. The tremor will, to a certain extent, add to the increase of inner temperature by producing heat, as shown by the experiments above referred to of Speck and Loewy. How different will be the effect of a regular *Brand bath, with frictions*, must be seen to be appreciated. As previously described, the cutaneous vessels are dilated, and more cooled blood is carried to the interior, to be exchanged for hot blood. On the other hand, if a nerve or heart stimulus is the chief object of the bath, a

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brief application of cold, with mechanical force to the surface, as described under the head of half-baths, produces a reaction which does not, unless prolonged, affect temperature so decidedly (because the blood has not been exposed to the heat-lowering influence sufficiently long), but, by exciting the reflexes, brings the blood to the surface, deepens the respiration, and invigorates heart action, as shown above.

THE WARM TUB BATH.

The warm bath, consisting of water at and above the body temperature, is so familiar that it requires only mention in connection with the full bath. Its technique is simple, the chief point being that the patient is entirely submerged in the water, except the head. The *rationale* of such a bath of a temperature from 90° to 100° has been studied by Max Schüller on rabbits which he had trephined. He found that, if the body were immersed in warm water, a decided contraction of the pia mater ensued, and they remained contracted for some time. The well-known hypnotic effect of warm baths is thus explained. But, aside from this direct effect upon the cerebral circulation, there is a direct local effect upon the peripheral cutaneous nerve-endings, which has been studied by Heymann and Krebs, and recorded in Virchow's Archiv., Bd. 1, Hefte 1. They claim that the peripheral terminal ends of the nerves of sense are the media through which exciting or soothing effects may

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be produced. They claim that these nerve-endings are rendered succulent, and become blunted. They present quite an array of data to demonstrate that the slow imbibition of water reduces nerve irritability, while its withdrawal increases it. Krause's end bulbs of the nerves of sensation, as well as Meissner's bodies, may absorb water endosmotically, and, even in the absence of direct absorption of water, they may become succulent by the cessation of insensible perspiration in the lukewarm bath. That the cerebral condition may be influenced by the local state of the nerve-endings is a physiological fact, clinically verified by the effect produced by the warm bath in cases of eclampsia or other conditions of excessive nerve irritability. Heymann claims that the cessation of cerebral disturbances when the skin perspires may be fully accounted for by this blunting of the nerve terminals through their increased succulence.

CLINICAL APPLICATION OF THE WARM TUB BATH.

In the pyrexia of infants, we have in the warm baths a potent means for reducing the temperature, assuaging pain, and relieving nervous debility, without materially interfering with any of the functions. In this day of facile resort to antipyrin and its congeners, the following large statistical evidence may be of value: In the Jahrbuch für Kinderheilkunde (xxxii, 142) Eroess reports the results of his observations upon the use of antipyrin, quinine, and warm

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baths in the pyrexia of very young infants: "Among 431 cases of fever during the first ten days after birth, 145 were of short duration, the remainder continuing for several days; in 184 it was continuous, and in most of the others irregular. In 44 per cent. it was attributable to gastro-intestinal disorder, in 34 per cent. to some disorder connected with the navel. Antipyrin was given in doses of from 1 to 2¼ grains, repeated, if necessary, in an hour. The effect was good, as was that of quinine. *Better results were obtained from the warm baths* than from either drug. The temperature of the bath was 95°; duration, ten minutes; in weakly children, five minutes. Upon the general condition the result was very satisfactory. Sleeplessness and irritability usually disappeared, and the child fell into a quiet sleep, from which he awoke apparently improved. When the temperature is very high, a warm bath is an agent of the greatest value." The author has in this case followed the plan adopted throughout this work, viz., to summon large statistical evidence, whenever possible, to substantiate his position with regard to this much neglected remedy.

Reference to an *irrational application of the warm bath* may not be out of place here. In the convulsions of children the practice of plunging the struggling patient into a hot bath is as reprehensible as it is antiquated. Indeed, ere the excited attendants, who rush hither and thither for the bath implements, succeed in placing the infant into it, the attack is

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usually subsiding. It is this coincidence which has maintained the reputation of the warm bath in these cases. Chloroform inhalations are far more effective, if the attack be prolonged. It behooves physicians to discountenance this irrational bathing, which but adds to the excitement and trouble incident to such occasions.

Diseases of the Liver may be favorably influenced by warm baths. Roehrig has shown (Med. Jahrbücher, 1873) that application to the cutaneous surface may affect the portal circulation; irritating influences acting upon the skin are capable of producing temporary anæmia of the liver, and even cessation of bile secretion. Upon this principle, a bath which produces turgescence of the entire cutaneous area must be an active therapeutic agent. F. A. Hoffman, of Leipsig, claims that, although the ordinary warm bath does not act so energetically upon the liver, its effect is more protracted. In icterus he has used warm baths frequently, originally with the idea that accumulated bile elements might be eliminated by the kidneys and skin. These baths were so very grateful to the patients that he thinks no one should be willing to deprive himself of this valuable therapeutic factor in the future. He esteems the daily lukewarm bath as highly for liver cases as for those involving the kidneys, and he regards them as a necessary habit.

In kidney affections we have the testimony of this clinician to the value of the warm bath. He says

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that at the Dorpat Clinic he ordered almost every kidney patient a daily warm bath, and that he was convinced of its favorable effect. Since he adopted this course, he claims, he has had no uræmia. Although the number of cases was small, he cites this as a valuable clinical fact. It is impossible to explain this effect upon the renal circulation with exactness, but it is probably due to reduction of blood pressure in the kidneys and the consequent dilatation of their vessels. Without being able to explain the *rationale*, the empirical fact is demonstrable that an indifferently warm bath is a means for sparing labor for the kidney. A temperature of 104° to 106° is the most agreeable for these patients. (According to Lehman, a bath of 95° increases the urinary secretion most.) By friction in the bath, and subsequent rest in bed, the relaxing effect of the bath on the superficial vessels, and consequent sense of coolness and malaise may be avoided.

In anæmia, complicating obesity, Hoffman recommends warm baths as the chief remedy for withdrawing water from the system, which may be done surely, and be regulated by the power of endurance of the patient. The ordinary warm bath competes here with the more energetic hot air and Russian bath. Kulon calculated, while treating a corpulent patient, that between 400 to 700 grammes of water were lost in a bath of half an hour, at 100° to 104°.

In cardiac affections the warm bath is usually

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regarded as contra-indicated, but the injurious effects are often due to improper execution of the bath. It should not be of so high a temperature as to heat the blood; nor should the patient dress in the room in which he has bathed, and which contains much moisture; nor should he make great efforts in drying or dressing himself. Hoffman says justly that all these faults may be avoided, if the pulse and temperature are watched. With due regard to these precautions, the warm bath is an excellent remedy to regulate cardiac action, and a method of saving labor for it, which has a great future, because it may be continued indefinitely.

An unavoidable danger from the warm bath lies in its action upon the skin. The perspiration is greatly increased, the epidermis becomes succulent and better adapted for giving off watery vapor; hence, there is a tendency to cooling off after the bath, which may amount to a sense of chilliness. A rapid contraction of cutaneous vessels takes place. Thus, while it is our desire to relieve the heart, these decided variations in blood-pressure make an increased demand upon it. If, to avoid this, we carefully cover the patient, we incur the danger of fixing upon the cutaneous surface a layer of air which is saturated with vapor, which maintains the dilatation of the cutaneous vessels, and justly inspires the patient with the fear of taking cold. The tone of the vaso-motors is diminished in these persons. Under normal conditions the

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vaso-motor system provides for the correct division of blood in the whole body, preventing excessive contraction as well as dilatation. This equilibrium is disturbed by the warm bath, and a certain period is necessary for restitution of the normal tone of the surface vessels. In the healthy heart a cold affusion readily promotes the latter. But this cannot be regarded as a quieting procedure in abnormal cardiac conditions, and is only advisable in persons having vigorous hearts. Hence, it becomes important that the patient's cutaneous vascular tone be restored gradually. This may be done by rendering the skin slowly more bloodless by means of gradually drying with warm cloths. This may seem a trivial matter, but just such trifles render treatment effectual or harmful. Moreover, too active friction should be avoided in these cases, and woolen clothing should be worn. The latter not only protects the skin, which has been rendered tender and sensitive by the warm bath, but encourages by its roughness a certain amount of hyperæmia, which conduces to an increase of vascular tone. In advanced conditions of cardiac disease, still greater care is necessary in the use of warm baths. So long as there is no venous stasis, they may be used with advantage.

CONTINUOUS WARM BATHS.

Upon the theory of Heymann, referred to, may be explained the remarkable result obtained from these baths by Langenbeck (Deutsche Klinik, 1885,

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No. 37) in extensive burns and in after-treatment of amputation, and by Zeis (in No. 40, Deutsche Klinik), who gives excellent results in the treatment of contused wounds, and, as referred to above, by Hebra and Kaposi, who applied the continuous baths in pemphigus foliaceus and pruriginosus.

The preparation of such a bath requires some skill. A large tub is arranged so that the temperature of the water may be maintained at a comfortable rate. This may be done by connecting the bath with the hot and cold water supply pipe. By suspending a strong sheet within the tub in the shape of a hammock, and placing a rubber pillow under the head of the patient, he will be enabled to lie comfortably and to change his position. The tub should be covered with a blanket and rubber sheet, which are supported by light bars lying across the edges. The temperature of the water should be agreeable to the patient; the duration of the baths brief at first and gradually prolonged, and mostly omitted at night. The skin will become puckered, and may peel at first. This effect may be prevented or modified by anointing the patient before the bath, when he soon becomes accustomed to the change. A valuable contribution to the utilization of these prolonged baths was made by Dr. L. Riess, of Berlin, who applied them in acute as well as in chronic cases. There is no doubt that in acute disease the bath originated by Riess of 21° R. (88½° F.) *is the most efficient antithermic bath we have.* It

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will be noticed when we reach the discussion of the bath treatment of typhoid fever.

But the calming effect of the bath has been utilized by Riess in the treatment of over 1,000 cases of various types of brain and spinal diseases. There is no thermic effect upon the cutaneous nerves, no change of temperature, blood-pressure, cardiac action, or respiration, only a calming effect, due probably to the removal or diminution of the usual cutaneous irritations, which ordinarily are conveyed to the internal organs, especially to the nervous system, giving rise to a regulation and quieting, chiefly of the central nervous system. Cases of serious disturbance of the latter thus become amenable to treatment. Riess has treated paraplegias of the lower extremities, paralysis of the bladder, intestines, etc., occurring in tabes, myelitis, and similar diseases, which usually demand the use of the bath for the greater part of the day, on account of the bed-sores. The latter usually healed very rapidly, if not too far advanced. But, in addition, many symptoms, such as local spinal pains, eccentric pains of the extremities, distressing contractures, reflex convulsive movements, were alleviated. In similar manner these permanent baths acted in cerebral trouble, apoplexy with chronic meningitis, hemiplegias, and with unilateral contractures also, and upon general hyper- or anæsthesias, cerebral excitement and delirium, in the most favorable manner. The calmative influence produced by

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neutral baths upon the condition of excitation of the brain is the chief basis of the therapeutic effect in these nervous diseases. The regulation of the peripheral irritations alone seems to suffice for the explanation of the effect; especially is the relief of insomnia a marked result of these baths. But Riess was not content with the improvement of a few leading symptoms. His observations, made in the course of twelve years in the Berlin City General Hospital, refer to a retrocession of the pathological processes, whenever this was still possible. In not a small number of cases of disease of the brain and spine, treated for weeks by permanent warm baths, a decided improvement of the diseased condition was noted. Motor and sensory paralysis, ataxia, and related symptoms yielded in these cases, after failure of other treatment. In cases amenable to improvement, namely in the initial stages of inflammation and absorbable exudations, the bath appeared to contribute to the cure, just as is the case in the mineral baths, which have been known to produce remarkable change in such cases, where prolonged sojourn in piscines was practiced. Riess gives the history of a case of compression myelitis, in which the patient spent the whole day in the bath, the night in the bed, and which resulted after 8½ months of constant treatment in complete restoration of the function of the cord!

In cases of cystitis the treatment by irrigation is

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much more successful when combined with the bath. He mentions five cases, of which three recovered. In five cases of obstinate sciatica he succeeded in curing them. In chorea he obtained partial results. Pains of multiple neuritis were relieved. In anasarca, due to heart and kidney trouble, he obtained especially good results, although in these cases there was a decrease of urine. They should, therefore, not be used when the latter is scanty. In several obstinate cases of articular and muscular rheumatism, in which all other treatment had failed, he obtained good results from daily baths of twelve hours' duration. In almost all cases he obtained an improvement of the general nutrition. Diarrhœas especially seemed to improve. There were no disadvantages from these baths in properly selected cases. Patients soon got accustomed to them, when they realized their calming and hypnotic effects. Realizing such results from so reliable a source, the baffled attendant may find in these prolonged baths a resource of incalculable value after all other measures have failed.

PEMPHIGUS.

The prolonged warm bath was introduced by Hebra for the treatment of pemphigus foliaceus, a disease which resists all remedies. Kaposi speaks of this bath as an inestimable protective remedy, which furnishes the best relief for the pains, fever, and loss of sleep and appetite during the eruptive period, to

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which the patient must otherwise succumb. Kaposi has saved a patient by one of these baths for four years. It was used continuously, with the exception of brief intervals; once he continued in it with great benefit for eight months, night and day.

In extensive burns, Langenbeck and Hebra have brought this continuous bath into effective use. When there are large suppurating surfaces, the exclusion of air and constant cleansing of the parts by this immersion must serve to further healing. In these desperate cases vast suffering will be saved to the patient, and much trouble to the attendant.

LOCOMOTOR ATAXIA.

In this obstinate and unsatisfactory disease, the large number of medicinal agents recommended demonstrate our therapeutic helplessness. We must agree with Prof. Leyden, who says (Internationale Klinische Rundschau, 1889) that, while medicinal agents only serve to infuse hope into the desperate patient, warm baths belong to the most important therapeutic methods in tabes, and their correct and careful application is of the greatest importance. While they cannot be credited with curing the disease, they produce a beneficial, quieting, tonic influence. Patients must be warned against too great numbers of baths and against excitement from too high temperatures, or strong salt or CO_2 ingredients. The baths should be given with the greatest care and comfort, to avoid

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taking cold, or being otherwise injured. . The temperature should be guided by the season of the year and the individuality of the patient (86°–92°–95° F.), and the duration should be 5, 10, or 20 minutes, according to the effect. The latter may be expected to manifest itself in improvement of strength, calming of pains, and mild excitation of the sensory nerves. It is possible that the latter may exert a favorable influence upon upon the degenerative process, and effect its cessation. Simple warm baths, without any or with very little addition, are most appropriate in the initial stages. Vapor baths, though useful in these, are objectionable in the chronic stages.

From personal experience the author can corroborate these wise directions of Leyden regarding baths in tabes, and they apply with equal force to other chronic degenerative nerve lesions.

In no form of disease need skill and judgment be more carefully applied to the relief of suffering. A careful consultation with someone familiar with hydrotherapy is regarded as valuable, even by such men as Leyden, Erb, Binswanger, and other nerve specialists, who habitually send their patients to hydrotherapeutic establishments which are under the management of educated physicians, to whose judgment, rather than to their own, these eminent men prefer to entrust the hydriatic treatment of the cases.

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CHAPTER III.

THE DOUCHE.

This is a method of applying water in a more or less concentrated form, without direct intervention of an assistant, its chief element being the use of a certain amount of force derived from atmospheric pressure. The hydriatic procedures hitherto described were executed by an assistant, whose hands applied the water directly through the medium of a sheet to the body. The douche is the only procedure in which the mechanical effect is brought about without the intervention of a second person, who is replaced by the force derived from atmospheric pressure.

The origin of the douche may be traced as far back as the Roman Empire, when it was known as *balneum pensile*. The first time the term douche is encountered in literature is in the writings of Pietro Toussignano, who described the baths of Bornio in 1336.

The modern douche employs the valuable mechanical contrivances by which water is delivered under great atmospheric pressure from a reservoir, which in cities feeds the ordinary water supply, or into which it has been pumped. The French have improved this hydriatic procedure, and really have made it the chief among all. Charcot's name is well known as connected with this application, because his

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phenomenal success in utilizing the valuable knowledge, acquired by his countryman Fleury and others, in this branch of the art, has added to the great fame he has justly acquired as a diagnostician and practical neuro-therapist.

Hydrotherapy is, as the French, represented by Duval, who is the most voluminous author on the subject, term it, a perturbating action. This disturbing effect, produced by the more or less violent impingement of water upon the skin, is due to the same elements which in other procedures have been shown as necessary for the evoking of reaction, viz., the mechanical and thermic. The mechanical effect is enhanced by the height from which the stream falls and the size of the outlet.

In Germany the shower-bath and stationary douche are used a good deal, while the French have improved upon this by adopting the douche mobile. The latter is a nozzle connected with the pipe at the outlet of the reservoir, by means of a flexible rubber hose, which enables the attendant to direct the stream upon any part of the body. The size of the stream may be modified by various nozzles screwed upon the hose; giving either a fine jet, whose diameter may be so small that it may perforate the skin under great atmospheric pressure, as in the *douche filiforme*, or so large that it strikes the body like a flexible hammer, or in numerous fine streams at once from a sprinkler. The thermic effect may be modified by the temperature of the water issuing from the nozzle.

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The douche differs from other procedures in this respect. It may be administered at a lower temperature, because the mechanical effect is simultaneous, and thus enhances the rapidity of reaction.

Here, too, the law referred to above is fully exemplified, viz., the colder the water and more brief its application, the more complete the reaction. As we are enabled by the douche to overcome the paralyzing effect of any low temperature by the stimulus of the mechanical effect, we possess in this procedure the most powerful therapeutic weapon. This explains the great success of the French with the douche.

There are other advantages connected with it. The brevity of its application, which should never, at low temperature (below 55°), exceed one minute upon any one part, saves much time and renders it much less disagreeable. The cold is not felt as a painful impression, as would be the case were the individual immersed in a tub of water at the same temperature. The rosy hue of the skin, which frequently ensues immediately upon the impingement of the douche, indicates at once that the chief end of hydrotherapy is being met, viz., reaction. The *rationale* of the douche may be explained upon the general principles laid down in the first part of this work, and need not be reiterated here.

It is only necessary to dwell upon the fact that every physiological indication is fulfilled exactly. The nervous centres are aroused, the respiration is deep-

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ened, the circulation invigorated, the secretions increased. The local action of the douche is also valuable. It is practically a thermic massage. It excites intensely the neuro-vascular structures; hence it is an admirable sorbefacient of pathological products. In the form of the Scotch douche, which consists of alternating streams of hot and cold water, it is specially applicable in the latter. Its effects are enhanced, as in other procedures, by preceding applications of warmth, with or without moisture. The French are fond of using the hot-air box-bath; the Germans prefer the dry-pack, by which the sensitiveness of the skin is enhanced, as in other procedures, and with it the reactive capacity.

The apparatus, illustrated on page 70, was designed by the author and constructed under his supervision for the Montefiore Home by the Mott Iron Works of New York. The drawing, reproduced from an electro kindly furnished by Lea Bros., of the illustration on page 503, Vol. I, American System of Therapeutics, furnishes a birdseye view of the apparatus on the left. The water supply comes from the Croton service, with a pressure of 32 pounds to the square inch, as registered by a gauge in the douche-room. There are three sources of supply to the latter —hot, cold, and iced water, the latter being necessary in summer, when the Croton water registers as high as 80° sometimes; it is obtained by passing the water through galvanized iron coils lying at the bottom of a

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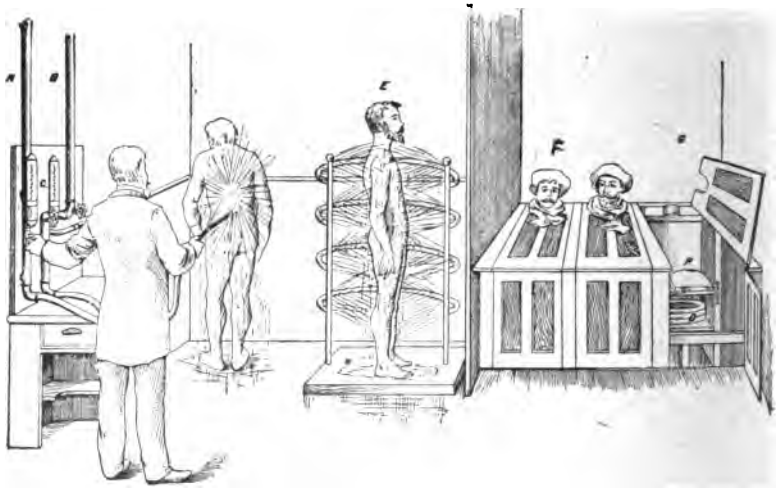
water-tight wooden box, and protected by wooden slats, which separate the coils from a quantity of ice lying above it. Thus, all the water passing through this coil is rapidly cooled, so that the lowest tempera-



tures required may be obtained during the hottest weather. In order to compensate for the loss of pressure by friction in the coil, this supply was connected with the high-water service, which furnishes a pressure of 40 pounds, equal to a fall of 80 feet. This may be diminished by reducing the volume of water by the stop-cock. The pressure here is ample, being greater than in any of the Parisian institutes, six of

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which I have inspected. The highest fall claimed there is in Duval's Institute, Rue de Dôme, 60 feet.

The floor of the douche-room is covered with asphalt, upon which movable slatted frames are placed to prevent chilling the feet. The walls are constructed of marble slabs eight feet high.

At the Hydriatric Institute, constructed for private patients, at 635 Park Avenue, the douche-room is 12x18 feet. The walls, lined with marble, are eight feet high. The floor is of wood, covered with zinc plates, with a graduated fall towards the front edge, which contains the outlet to the sewer. This floor is covered by a slatted (movable) floor, upon which the patient may stand without becoming chilled, and through which the water flows off readily. Near the distributing-pipe stands a counter or table. Behind this the nurse or physician giving the douche may stand protected against the return spray. At the upper end of the douche space, on the left, stands the rain-bath. This is a modified douche, consisting of a combination of four circles of inch pipes, nickel-plated, about three inches apart. These are perforated by three rows of fine apertures, the upper row directed downward, the middle forward, and the lower upward. This is connected by an inch pipe with the distributing apparatus which the nurse controls. The patient, standing within the circle, receives a large number of fine streams of cold water simultaneously. Ice-water is furnished by a separate pipe

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coming from two galvanized iron boilers covered by several tons of ice in an ice-box. By a waste arrangement the pressure of the water may be diminished or increased while it is being registered on the gauge.

The therapeutic indications of the douche are numerous. By variations of temperature and pressure, by changing the aperture of the nozzles, by increasing the number and form of the stream, as in the spray and fan douche and rain bath, the mechanical effects may be as materially modified as the thermic effect may be by increasing or reducing the temperature of the water. As a general invigorant the douche excels all other procedures in cases in which muscular energy is in abeyance, whether the loss be secondary to other conditions or primary. The experiments of Maggiora and Vinay (detailed in Blätter für klinische Hydrotherapie, Jan., 1892) show clearly that a rain douche of 50° F., under a pressure of two atmospheres, increases threefold the sum of work the muscles are capable of doing. The Scotch douche, oscillating between 98° and 53°, doubles the capacity of the muscles. Even douches of tepid water increase the number of muscular contractions and amount of actual work of the muscles, while a tub bath of the same temperature is without decided effect.

These experiments were made with the Ergograph of Mosso, which registered automatically the muscular resistance. We have thus a basis for the well known refreshing and invigorating effect of the douche,

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which in France is so advantageously resorted to by men and women of feeble muscular fibre, by people who lead sedentary lives or lose their vigor in the whirl of fashionable dissipation. To endow the feebly-muscled children and youths with strength, to invigorate the lax fibre of those men and women who either have no time or inclination to indulge in normal exercise in the open air, there is certainly no measure more valuable than the cold douche, carefully adapted to each individual in duration, temperature, and pressure. I do not refer here to diseased conditions, but simply to abnormal feebleness of muscle and the incapacity for normal work.

In all those diseased conditions, however, in which this loss of muscular vigor is the result of feeble digestion, of depreciated nerve tone, or even of organic disease, the douche in its numerous modifications offers a method of restoring vigor which has often surprised me by the rapidity and completeness of the result. For there is no hydriatic procedure that can approach it in improving the general circulation, as well as the tonicity of the smaller vessels and of the tissues. It deepens the respiration, and thus gives rise to the exchange of gases which enhance tissue change. As Pospischl says: "The mechanical massage produced by a good fan douche sets the diseased structures into a vibration which cannot be under-estimated and is not to be approached by ordinary manual massage."

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It may be used in feeble subjects who are able to stand because it does not abstract much heat, and may be preceded by the dry-pack, or brief hot-air bath, which accumulates all the heat to be abstracted, upon the surface, and thus forestalls any actual loss.

In *anæmia* and *chlorosis*, in *hypertrophies* of the liver and spleen, in *neurasthenia* of the depressed type, with introspection and melancholic ideas, in *gastric* and *other troubles*, requiring a heightening of muscular energy; in all those conditions in which an elevation of nerve tone is demanded, we have in the douche a most powerful weapon for good, and I may say also for evil. Like a two-edged sword, it may inflict damage when carelessly used. It should never be administered without the prescription of a physician, who should designate the duration, temperature, and amount of pressure. I am cognizant of an eminent neurologist having given a patient an order to a bathing establishment as follows: "Give the bearer a douche." He might as well have given him an order to the druggist: "Give the bearer some strychnine." The difference, however, is in favor of the strychnine prescription, because every druggist is educated in the knowledge of the toxic doses of medicines, whilst few bathing establishments have attendants who are educated in the much more intricate dosing of a douche, whose effect is governed, not only by the temperature, pressure, and duration, which may be mathematically measured, but by the constitutional

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peculiarities of the patient and their modifications by the existing disease. This brief review of the mechanism, *rationale*, and therapeutic indications of the douche offers the principles for its application which would enable the intelligent physician to adapt it to the various diseases in which an improvement of assimilation and hæmatosis, elevation of depreciated nerve tone, equalization of perverted nerve force, absorption of pathological products, or increase of tissue change is demanded.

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CHAPTER IV.

THE SITZ (HIP) BATH.

The sitz bath is a partial submersion of the pelvic portion of the body in water, including the lower portion of the abdomen. The patient retains his upper clothing, or is comfortably clad and covered with blankets, and the feet are placed upon a blanket. After he is seated in a bath containing a sufficient quantity of water to completely cover the hips, the foot blanket is carried over the thighs and tucked around the tub. The latter should have a high back upon which the patient may lean, and its under edge should be rounded and smoothed, so as not to be uncomfortable. Moreover, the feet should be supported, so that the popliteal space clears the edge of the tub. The patient's head should be covered with a damp turban to prevent retrostasis.

The exact and interesting experiments made by Drs. Schweinburg and Pollak, under the guidance and at the suggestion of Prof. Winternitz, afford a rational basis for deducing the therapeutic effect of hip baths. The individual was placed into a empty tub, in order to avoid errors arising from change of posture, and covered with blankets. Dudgeon's sphygmograph was secured to the radial artery in a comfortable position of the arm; the carotid pulse was counted, and the blood-pressure was recorded at the

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temporal artery. Now water at the desired temperature was poured into the tub. Thus the observations were made before, during, and after the hip bath. The results were as follows: The hot hip bath (104° –113° F.) produced almost without exception slight increase of the pulse rate and occasional considerable reduction of blood pressure, while the cold bath (50° –54½°) produced a slight diminution of the pulse rate and an occasionally considerable elevation of blood-pressure. According to Winternitz, the sitz bath is a potent factor in influencing the circulation of that immense vascular area comprised in the intra-abdominal vessels. This system of vessels may be compared to a reservoir of flexible dimensions, whose mission it is to receive temporarily all blood from other parts, to which it is again returned when needed. The capacity for changing their calibre and area renders the intra-abdominal vessels a kind of safety valve for regulating the pressure relations in the entire vascular system, as has been shown.

Any procedure, therefore, which may powerfully influence these vessels must be potent for good as well as evil. It has already been mentioned in the first part of this book that the pletysmograph distinctly registers an increase of volume in the upper extremities when an individual is placed into a cold sitz bath. There is a rush of blood to the head, manifested by the usual symptoms. Otherwise the effect is the same upon the respiration, circulation,

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tension, etc., as from the impact of cold water upon any other part of the body. There is no other method by which blood may be driven to the upper portion of the body. All the effects of this bath may be traced to a reflex excitation of the sympathetic nerve.

Hip baths of from 50° to 60°, of from 10 to 20 minutes' duration, excite the vaso-motor nerves of the abdominal organs, contracting these vessels, diminishing their calibre and contents, and, as a result, the intestinal secretions and peristaltic movements.

The therapeutic indications based upon this *rationale* of the action of the hip bath are readily deduced. In all conditions of the hyperæmia of the intra-abdominal organs in diarrhœa and dysentery, hip baths may be of great service. Brief dipping of the lower abdomen into cold water, on the contrary, produces hyperæmia of the organs, increasing the tone of the intestines, enhancing their functional activity, while prolonged hot or cold hip baths (of one or two hours' duration) produce a relaxation of the intra-abdominal vessels and a corresponding effect upon the blood-distribution in neighboring parts. Winternitz insists, and I am able to corroborate this clinical observation, that there is no remedy which is so efficacious in the most obstinate diarrhœa as a cold hip bath which has been preceded by an energetic wet sheet rubbing. The latter increases the cutaneous vascular area, while the hip bath of 50°–66° F. excites the sympathetic, contracts the intestinal vessels, and diminishes peristaltic action, if prolonged.

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In disease of the urinary and sexual organs, brief cold hip baths are useful, when there is a sluggish circulation or stasis from chronic congestion or inflammation, while in active pathological conditions they are contra-indicated. Hence in impotence, spermatorrhœa, relaxed conditions of the ovaries, the uterus and its ligaments, in amenorrhœa and passive menorrhagia, these baths are indicated, as also in congestion of the brain, lungs, and liver, in gastric and intestinal ailments, constipation, etc. They are especially contra-indicated in all irritable conditions of the uro-genital organs, with frequent emissions.

There is no greater and more common error than to suppose that ordinary cold hip baths are calming or depressing to the pelvic organs. It is certain that a very brief dip of the pelvis into cold water increases the energy and pressure of the portal circulation. The prolonged cold hip bath, on the contrary, reduces temperature for the time, and may prevent reaction and consequent excitation. These act as tonics, and aid in relieving inflammatory conditions, if they last 30 or 60 minutes and are 56°–64° F. In cystitis, urethritis, uterine hæmorrhage, and prostatitis, in diarrhœa, dysenteries, these prolonged hip baths are exceedingly useful. When a decidedly calming effect is desired, the warm hip bath of one or two hours' duration, 90 to 100° F., is a long-established remedy for vesical tenesmus, in menstrual pains, etc.

But the most valuable pelvic antiphlogistic hip bath is the lukewarm bath, 70° to 80° F., with friction.

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The author has found a gradually-cooled hip bath, beginning at 90° and gradually adding ice-water from a pitcher so as not to touch the body, useful in utero-vaginal difficulties, when not connected with pus formations.

The numerous partial baths described in hydropathic literature are not here detailed because the author has had no experience with them, and his reasoning upon the subject leads him to adopt the course of simplifying hydrotherapy by omitting all procedures not capable of a rational therapeutic basis.

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CHAPTER V.

AUXILIARY METHODS.

Experience has demonstrated that the therapeutic results of all hydriatic measures are greatly enhanced by certain auxiliary measures, which are either preparatory or are practical in connection with them. The most conservative practitioners and clinical teachers constantly refer to these. Prof. Semmola tells his classes in the Naples University (page 230 Clinical Therapeutics, translated into German with a preface by Prof. Nothnagel, of Vienna): "In visceral troubles, which defy all treatment because they are favored by special alterations in the tissue-changes, the physician may accomplish in many cases a true and real cure by endowing all the functions of the organism with the highest activity without the aid of medicinal agents, *i. e.*, solely and purely by the application of *ordinary physiological agents*, and, above all, of hydrotherapy. The methodical, internal and external, use of water, *together with climate, exercise, etc.*, are the means by which hydrotherapy stimulates cutaneous activity, and with it all functions of tissue change and organic purification, so that often real marvels of recovery are obtained in serious and desperate forms of disease. Unfortunately, these wonderful effects are more rare to-day than they were in the time of Priessnitz, and of which I was a per-

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sonal witness. Those who were in a position to follow up the cures of Priessnitz will remember well what marvelous and unexpected recoveries were accomplished at Gräfenberg by means of the water treatment." And Prof. Erb, of Heidelberg, after referring to the effects of baths (Diseases of Spinal Cord in Ziemssen's Cyclopædia) as "extraordinarily favorable in all possible forms of chronic troubles," says: "If we add to these the increase of perspiration by certain procedures, the effect of increased water consumption and muscular movements, the influence of diet, climate, altitude, it is evident that we possess few remedies which exert an equally powerful influence upon the nervous system."

Erb's opinion of medicinal therapeutics is not very high, as is evident from the following comments upon "chemical or internal remedies. Here we enter upon a very obscure field which needs thorough cultivation. We know almost nothing of it; the little which therapeutic experience has taught us is neither securely established nor in any way scientifically or intelligibly founded." These recognized teachers are here cited to illustrate the fact which I desire to impress, viz., that water is not a universally applicable remedy which may be relied upon alone and unaided in the treatment of diseases. It is the just boast of the empirics that they have utilized diet, exercise, and regulation of habits as auxiliaries of water. The educated physician makes no such boast, for he has,

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for centuries, studied and practiced these methods, but he has not until recently applied them systematically. An excursion into the field of auxiliaries is tempting, and may not be without interest to the reader. In an essay read before the 86th meeting of the New York State Medical Society this subject was briefly treated (The Successful Treatment of Chronic Diseases—A Plea for their More Methodical Treatment) as follows: "I regard it it as of paramount importance to impress upon the patient the need, not only of systematic diet, but of systematic exercise. Unless the physician be convinced of this, he will permit the disinclination of all diabetics to exercise to overcome his injunction. The latter can not be made too strong. *A certain amount of exercise must be prescribed and taken.* I advise the use of the pedometer for the purpose of measuring and recording the amount of walking exercise; which is by far the best taken by the patient. Why should we not have an exact estimate of so important an item of treatment? The patient's statement may be a fair guide in some cases, but his physical condition renders him a prejudiced witness, be he ever so honest in his intentions. Whenever we shall dose our exercise as we do our medicines, and see to it that our prescriptions are followed as punctiliously as we are wont to do in medicine, we shall achieve greater precision in our results. In the discussion of the treatment of diabetes in the New York Academy of Medi-

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cine, on March 18th, 1888, I endeavored to emphasize the importance of active and passive exercise *adapted to the requirements of each case.* So convinced was I of the value of this therapeutical measure that I had adopted the method of compensating my diabetic patients for taking the prescribed exercise by a definite allowance of white bread (for which they all crave), graded according to the amount of exercise taken."

Electricity, diet, exercise, climate, etc., are so well treated in many works that no special reference shall be made to these except to insist upon the necessity of their more methodical, simplified, and systematic application. Many chronic diseases would thus be cured which otherwise succumb because of insufficient attention to details by both physician and patient. There is one measure to which attention may be usefully directed at this point, because its object is to increase the reactive capacity of the patient. It thus becomes an important part of hydrotherapy.

THE HOT-AIR BATH.

Rationally and not indiscriminately administered, as is done in Turkish baths, but in the form of what the French call *étuve sèche*, the hot-air bath presents so many therapeutic advantages that a detailed description is necessary.

The apparatus in use at the Montefiore Home (see illustration) and at the Hydriatric Institute in New York City consists of three air-boxes, each 2¼

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ft. wide × 4 ft. deep, and 3 ft. high. They are shaped as shown in the diagram. The front and upper portions consist of two doors, which open on hinges. The seat being adjustable, the patient is placed high enough to enable him to move his head comfortably above the collar opening. The door being closed, he is surrounded by hot air, derived from a large metal radiating coil connected directly with the boiler, so as to be independent of the ordinary heat supply of the building, and thus be utilizable in summer as well as in winter. Practical experience with this apparatus during the past three years proves it to be absolutely perfect, though very simple. The temperature of the air surrounding the patient is controlled by a valve, and may be easily raised to 180°. This is rarely necessary, however.

The patient's head is enveloped in a wet turban after he is seated, and the collar opening, which is large enough to permit permit freedom of motion, is covered by a bath towel to prevent escape of heat. The pulse and mouth temperature are taken and recorded every ten minutes. After the desired rise of temperature and perspiration are obtained, the patient is subjected to a cooling douche from 100 to 50° F., as indicated in each case. The advantage of the hot-air bath over the ordinary Turkish bath is evident. The patient breathes cool, fresh air while his body is subjected to the heating; he is not stifled.

Rationale.—Anton Frey (Volkmann's Sammlung

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klin. Vorträge, No. 332) has given us an admirable résumé of the *rationale* and effects of the hot-air and vapor baths. As has been shown in the first volume, if the body is exposed to temperature changes, the principal effect is an irritation, accompanied by dilatation of the cutaneous capillaries after heat, and their contraction after cold. It has been shown how powerfully these manipulations affect the heart action and blood-pressure, heat production, and tissue change; indeed, all organic functions. That the system protects itself against injurious temperature changes has also been demonstrated, chiefly with regard to external applications of cold. The same principle is applicable in explanation of the *rationale* of the hot-air bath.

We have here three factors—the thermic irritation, the heat supply and loss, and the protective action of the organism against these. The temperature equilibrium of the human body is due to two constantly active factors, heat production and heat diffusion. These are under control of the nerve-centers, which are connected on the one hand by cerebro-spinal and sympathetic fibres with the tactile nerves of the skin, and on the other with the abundant capillary network of the skin and muscles, both of which respond to the slightest temperature impressions by narrowing or dilating the cutaneous or muscular capillaries. Thus are the production and diffusion of heat regulated. It becomes evident that

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this responsive action of the nervous system differs in different individuals, and even in the same individual at different times.

In five minutes, usually, the pulse rate begins to increase; five minutes more mark a rise of temperature and an increase of respiratory movements. The average normal case may within half an hour be made to register an increase of thirty to fifty pulse-beats, and of one to three degrees of temperature.

The skin becomes hyperæmic and succulent, and its tactile and electrical sensibility is heightened. Owing to the absence of a muscular coat, the capillaries are really only thin structures, practically elongations of the inner arterial coats, and depend for firmness and elasticity upon the surrounding structures. As the latter are expanded by heat applied to them, it follows that the thread-like capillary must become dilated to many times its calibre, and is thus made to receive more blood.

It has been ascertained by the pletysmograph, which measures the volume of parts exactly, that not only does the body, especially the extremities, increase in circumference, but that the increased pulsation of the heart sends blood with more force to the non-resisting and enlarged capillaries. But that such an enormous diversion of blood to the surface must change the existing conditions of the circulation, disgorging the venous system, the kidneys, liver, and spleen, may be easily understood. A. Frey has ascertained by the

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sphygmograph and sphygmanometer that the vicarious emptying of other organs cannot entirely compensate this centrifugal flow, but that there is a loss of pressure in the entire vascular system, a loss of tension of the vessel-walls. The heart requires less labor to send the blood forward, because the peripheral resistance is diminished. On this principle may be explained the faintness, tinnitus aurium, and symptoms of cerebral anæmia which sometimes ensue, and which are more frequent in the Turkish bath, where hot air is inhaled and thus locally applied to the pulmonary capillaries also. So soon as the surface temperature is reduced by the cold bath or douche, the previously anæmic organs become again full of blood. Herein lies danger, if there exist a brittle condition of the vessel-coats or a cardiac lesion.

For this reason it is best in elderly or otherwise feeble persons to lower the temperature gradually, to allow the inner organs to accommodate themselves. If the proper douching and friction have been practiced, the skin will remain sufficiently hyperæmic to present a rosy hue. But this is not a relaxation, it is a tonic condition, which assists the heart in propelling the blood through the vessels. The pulse remains somewhat more frequent, becomes soft, and the blood pressure is lowered a little. The therapeutic advantages arising from this condition are self-evident. The respiration is as much affected by the hot-air bath as the circulation.

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The thermic irritation of the periphery excites reflexes which accelerate the breathing; besides this, the super-heated blood stimulates the vagus also. I have often noted a respiration of 25 per minute, although the inspirations are deep. The cooling process reduces the number of respirations according to its intensity and rapidity, although, like the temperature, they remain more frequent than normal for a time. It is fair to assume that the increased excretion of CO_2 and increased demand for oxygen indicated by the enhanced respiratory processes are manifestations of increased oxidation. The urine affords corroborative evidence on this point, and this evidence is the more valuable since we may obtain it with some degree of precision. The quantity of urine is reduced about one-fourth by the hot-air bath in persons who take constantly the same amount of fluid. This reduction is not as great at the time of the bath as during the four or five days succeeding it.

This may fairly be explained by the effort which the organism is called upon to make in order to eliminate the waste products which the bath produces. The specific gravity of the urine increases in proportion to the diminution of the quantity, but this increase continues even after the urinary volume is restored to normal. Thus we have positive evidence of the increased production of the solid urinary products. Urea is clearly excreted more abundantly; about one-third more is eliminated on the day of the

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bath, and this increased elimination continues in less quantity until the fifth day. If fluid is moderately drunk during the bath, the increase of urea is not so great immediately after the bath, but is greater during the five days succeeding it. There is evidently a retention of urea in consequence of insufficient urinary water, but the average of the six days is nearly the same whether the patient drinks water or not, and *affords a positive measure of the increase of tissue change.* The *uric acid* excretion produced is doubled and even trebled; it is greatest in the urine passed after the bath, but diminishes rapidly during the succeeding days. The quantity of sulphuric and phosphoric acid is also decidedly increased during and after the hot-air bath.

An interesting table, constructed by Godlewsky, demonstrates clearly that under the influence of hot-air baths a decided acceleration of oxidation of nitrogenous substances (nutrient and tissue albumin) is inaugurated, which lasts several days. Since, however, it would be impossible to maintain an increased heat supply necessitated by the continued heat diffusion for so long a time, an increased combustion of fat becomes necessary. This is entirely in accord with the daily observation that hot-air baths are competent to produce rapidly a very considerable reduction of fat in persons who have reduced their consumption of fats and liquids. Experiments upon animals also teach this lesson. Hence we possess in

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these baths a means of inducing and maintaining a considerable acceleration of oxidation. The body offers for this purpose the necessary nitrogenous and non-nitrogenous materials (Frey).

The quantity of perspiration produced by the hot-air bath differs greatly in different individuals and at different times. In a recent case, now under observation by myself, a young man of sixteen, student at the Stevens Institute, weighing 188½ lbs., with a girth of 38 inches, lost 3½ lbs. the first bath. The urea, which was before the bath 6 grains to the ounce, increased to 8 grains to the ounce in the urine passed after the bath. After three baths there was a total loss of 3½ lbs. and a decrease of 3 inches in the girth, so that his trousers were perfectly loose. Before the fourth bath he had regained one lb.; after the fifth bath the urea was 8½ to the ounce. These measures were made by my son, H. B. Baruch, and the case was observed by Dr. Max Rosenthal.

The therapeutic results of hot-air baths are summed up correctly by Frey as being the outcome of increase of tissue-metamorphosis due to the elevation of temperature and the elimination of its end products; they change the hæmostatic equilibrium by inducing a more active cutaneous circulation, and increase the elimination of water.

Obesity, *chronic rheumatism*, *gout*, and certain cases of *anæmia* offer indications for valuable therapeutic results from these baths.

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In recent myalgias and neuralgias, lumbago and other forms of muscular rheumatism, indeed in all those affections for which the Turkish bath is usually prescribed, the hot-air box, as here described and carefully observed and guarded by frequent examination of the patient, followed by douches of temperatures judiciously adapted to each case, must be regarded as far exceeding in value and extent of applicability the empirically used Turkish baths.

Anton Frey has observed valuable results from hot-air baths in cardiac diseases, even in cases in which there is an insufficiency of the heart-muscles, or valvular disturbance, with consequent loss of compensation. In the latter greater care must be exercised, but we may accomplish a good deal in them, as in all cardiac diseases, by inducing hyperæmia of the skin and consequent removal of peripheral resistance to the blood current and diminution of blood pressure. Care must be exercised, however, in the cooling process, which must be gradual, with friction to maintain the patulous condition of the cutaneous vessels. My personal observations on the value of these baths were illustrated in a paper before the New York State Medical Society, at the 86th annual meeting, February 6, 1892.

In *syphilis*, when the system has been saturated by mercury, whose elimination is desired, we have a valuable eliminant in the hot-air bath. The experiments of Borovsky (British Journal of Dermatology,

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1889), showing the comparative value of various baths, prove that, "as a means for freeing the patient's system from mercury, hot-air baths should be preferred to all other baths; hot-air baths at 170°–180° of twenty minutes are borne better than those at 140°–160° of thirty minutes, and act better than hot-water baths, which sometimes give rise to faintness; hot-air baths, by inducing intense thirst, increase the ingestion of liquids and then enhance metabolism."

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CHAPTER VI.

HYDROTHERAPY IN FEVERS.

The technique of the methods usually resorted to has been fully described, together with the *rationale*. Fevers offer the most prolific field of hydrotherapeutic success. If we dwell upon them more fully, perhaps, than upon any other subject, the importance arising from the frequency, universality, and fatality of some fevers furnish ample warrant.

The frequent revival of this subject in our medical societies is evidence, not only of its incalculable importance, but also of the instability of our present therapeutic methods.

Brilliantly and learnedly though we may discuss typhoid fever, favorable though our individual statistics may be, still the figures of our Board of Health reports bid us "mend our ways" in language more eloquent than human tongue or pen can formulate. Twenty-five to forty per cent. is the death rate from typhoid fever in our American cities; twenty-six per cent. is the mortality of the New York hospitals in recent years, according to Dr. Delafield's investigations. The import of these figures cannot be overestimated. May they be changed?

Happily there is a method of treatment which has the sanction of long usage, the authority of judicious clinical observers, and the evidence of unimpeachable

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statistics. To further the universal adoption of this method, I propose to devote all the energy of my nature, because I am a proselyte myself. I once said in the Academy of Medicine: "Plunging a typhoid fever patient into a tub of cold water may suit a German soldier, but it is not adapted to our American constitutions." I have lived to regret these words of derision, and, repenting thereof, I warn my colleagues against this prevalent error.

I have recently revised my experience, with the result of reaching some decided views, which differ radically from those generally entertained by the profession in this country, and, up to a recent period, by myself also. These views are the result of mature deliberation and sifting of evidence afforded by clinical and experimental data, obtained from various sources and compared with my own.

I need not dwell upon the various methods of treatment advocated during the past thirty years of my professional career. About ten years ago I had settled upon the Ziemssen graduated cold-bath treatment as the most promising, and I obtained more satisfactory results from it than from any other. Still, when other antipyretic methods came into vogue, with so much promise of success, based upon the idea that the reduction of high temperature was the chief desideratum, it was natural for me to be carried away upon the tide which so completely swept over the profession, especially as the treatment by cold baths

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involved so much trouble, and proved so disagreeable to many patients and their friends. Gradually the milder form of bathing, by wet-pack and sponging, with quinine, thallin, kairin, antipyrin, the ice-coil, and, later, antifebrin and phenacetin, have assumed potent sway over the profession. A review of experience in the last decennium, derived from personal observation in private and hospital practice and in that of many colleagues, as well as from society discussions, develops the fact that *the mortality of typhoid fever has not been reduced by the antipyretic method of treatment.* A fair, conscientious, and exhaustive review of the results of the various methods in vogue during the past twenty-five years will demonstrate that we stand to-day upon the threshold of a great epoch in the treatment of typhoid fever.

How fatal typhoid fever is at the present time may be gathered from the statistics quoted above. This mortality is even larger than that furnished by the recently gathered, careful statistics in Germany, which show that under the expectant treatment of 11,124 cases, the mortality amounted to 21.7 per cent. Dr. Murchison has compiled 27,051 cases, in which the mortality per cent. was 17.45.

Jaccond has collected 80,140 cases on the continent, with a mortality of 19.23 per cent. The English army statistics averaged, for the six years ending with 1877, thirty-two per cent. mortality; in the navy it was 25.5 per cent.

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These statistics, to which others may readily be added, were they not sufficiently large, present to us the appalling fatality of typhoid fever under the expectant, antipyretic plan, which seeks, by nourishing the patient, placing him in good hygienic surroundings, combating complications, and reducing the temperature, to conduct him to a safe issue. Much stress has been placed during the past quarter of a century upon high temperature, as the predominating element of danger in typhoid fever. It has been claimed that parenchymatous degeneration of the heart, kidneys, and other organs was the direct result of prolonged high temperature, and the chief energy of therapeusis was expended upon this hydra-headed monster. This idea was indeed sustained by, if it did not originate in, the marvelous success of the cold-water treatment, which Brand, of Stettin, in 1861, brought before the profession in Germany, and which was adopted, after some modifications, by Liebermeister, the high-priest at the altar of antipyresis, as well as by Jürgensen, Ziemssen, and others.

The history of this special subject is indeed instructive, inasmuch as it illustrates how surely bedside experience will, sooner or later, demolish the most stately structures erected by theoretical reasoning. Brand never claimed that this bath treatment was chiefly directed against the high temperature. On the contrary, this was a secondary object with him. Liebermeister's criticism (Handbook of General

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Therapeutics, William Wood & Co., 1885) is at once the best exposition and the highest enconium of Brand's method. On page 15 he says: "The work of Brand, which was published in 1861, ranks high above the level of the publications of the professional hydropathists of to-day. Still, the author occupies pretty much the ground of Priessnitz. The preëminent importance of abstraction of heat is not sufficiently recognized; the main action of water is more that of stimulation," etc.

Now, I propose to show that the standpoint of Brand is correct to-day, and that it is sustained by the most incontrovertible evidence of experimental study, seconded by clinical experience gathered from carefully recorded data. Thinking men are beginning to ask themselves the question: Has the introduction of these powerful antipyretics reduced the mortality of typhoid fever? Three years ago I answered this question in the New York Academy of Medicine affirmatively, but I stated my belief that the small improvement was attributable to the comfort afforded the patient more than to the removal of danger from high temperature. To-day, after an exhaustive review of the whole subject, I am prepared to agree with Brand, that the only advantage from antipyretic medication seems to be that the *patient is able to die with a nearly normal temperature.* The fact that the statistics of private and hospital practice show a mortality reaching beyond 24 per cent., since

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the introduction and abundant use of antipyrin and its substitutes, proves their inadequacy. And the fact becomes more glaring when statistics of the cold-water treatment reveal the astounding reduction of mortality to 3.9 per cent.

We have reached a point in the study of this subject, so fraught with deepest interest, where it is our solemn duty to pause, weigh the reasons of this enormous difference in the mortality, and ascertain if it may not be reduced. I propose to establish the fact that this mortality may be reduced, as Brand has reduced it, to *one per cent.!* Those who, like myself, have personally witnessed the fatality of typhoid fever in New York City, may, as I once did, shrug their shoulders in doubt. But a brief analysis of the reasons for the superiority of the bath treatment will demonstrate that this is not a chimera, but a substantial fact, based upon the most reliable clinical data.

Brand offers the statistics of 19,017 carefully gathered cases of typhoid fever (Deutsche Med. Wochenschr., 1887), which demonstrate that under the general influence of all kinds of cold-bath treatment, without, however, its strict enforcement, the mortality has been reduced from 21.8 per cent. to 7.8 per cent. But this is not all. He has obtained from twenty-three German and French distinctly designated sources the reports of 5,573 cases (to which I have added more recent reports), statistical evidence which has not yet been, and cannot be, controverted, and by

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which it is clearly shown that the cold-bath treatment, originally recommended by him, has reduced the mortality to 3.9 per cent. The latter, however, still contains many imperfectly managed cases. Eliminating these, the number treated strictly by Jürgensen, Vogl, Brand, and others up to January, 1887, amounted to 1,223 cases, of which 12 died, a mortality of one per cent. And yet this is not all, for the most significant fact deducible from these statistics is that *not one of the twelve deaths occurred in any case that came under treatment before the fifth day.* Brand boldly asserts, on the strength of these 1,223 cases, of which he treated one-fourth in private practice, the remainder coming from Jürgensen's hospital at Tübingen, Vogl's at Munich, and the military hospitals at Straslund and Stettin, that all cases of typhoid fever coming under treatment before the fifth day should recover. Medical statistics are proverbially unreliable, but the exactness of the figures presented by Brand, in his able polemic in the Deutsche med. Wochenschrift for 1887, cannot be doubted nor the deductions gainsaid, because they are furnished from civil and military life, from university clinics and military hospitals, in which the cases were observed by competent and well-trained men, and they have been confirmed by more recent reports, as I shall show.

Valuable as these statistics must be as an argument in favor of strict cold bathing, the results of the latter are better illustrated by some comparative sta-

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tistics made by several clinical observers. For instance, the official records of the Second Prussian Army Corps, quoted by Brand, show that while, from 1849 to 1866, the mortality among 1,970 cases was 26.3 per cent., it was reduced, among 2,714 cases of strict cold-bath treatment, to 4.3 per cent. This enormous reduction is the more glaring when this mortality of 4.3 per cent. is compared to that of other armies. In the French army, it was 32.2 per cent.; in the Italian, 28.6 per cent.; in the Austrian, 27.4 per cent.; and in the English, 23.8 per cent., during the same period. Indeed, so striking was the reduction of mortality wrought by this treatment in the German military hospitals, that the Prussian War Department deemed it incumbent upon itself to issue, on January 25, 1883, a circular to the medical service, in which it was urged that, "inasmuch as the Brand treatment has been instrumental in reducing the mortality of typhoid fever in the various hospitals from 25 per cent. to 8 per cent., we are justified in expecting that, with an increased perfection and more general adoption of this treatment, it may become possible to save a still larger number of sick men."

As doubt has often been cast upon the correctness of these statistical statements and their applicability to our own country, the following opinion from reliable sources may be of interest.

Dr. J. C. Wilson, of Philadelphia, now Professor of Practice in Jefferson College, wrote me on October

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16, 1890: "I confess to having entertained misgivings as to the accuracy of Brand's statements for a long time; but during the last two or three years communications from other sources, particularly those from the French army medical men at Lyons, Nançy, and elsewhere, as well as the confirmation from German sources, aroused a deep interest on my part; and I took occasion last spring to investigate the matter systematically for myself. *No one who has done this, following the method closely, and avoiding medication, can doubt the efficacy of the treatment.* In this community it would be at present impracticable to introduce the treatment to any great extent in private practice; but the publication of statistics which are incontrovertible, and which prove that the average mortality can be reduced from its present figures, perhaps 16 per cent., including hospital and private practice, to two or three per cent., will in a short time render the employment of baths practicable both in public and private practice. I find the trouble lies chiefly with our physicians, some of whom are closely hidebound and subject to traditions. But there are many others who are open to conviction."

In an able essay, read before the Lyoming Medical Society and published in the Medical News, Dec. 6th, 1890, Dr. Wilson goes carefully over the methods now in vogue, and endeavors to prove that the very multitude of plans and remedies shows a continued unrest and dissatisfaction with existing methods of

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treatment, and "when we come to apply the test of efficiency in their influence upon this death rate, dissatisfaction with existing methods finds ample warrant." He furnishes his own experience in clear language, showing that the statements made by European observers were fully realized in his series of cases. He says: "Severe symptoms were mitigated, and mild cases ran a most favorable course. As a rule, patients did not object to the baths. When they did so, their objections ceased after a few baths had been administered. Complications were trifling, there were no sequelæ, and in every case the convalescence was rapid and satisfactory."

In a lecture published in Lippincott's International Clinics, for July, 1891, p. 19, Dr. Wilson says: "This treatment has consisted almost exclusively in a routine procedure, and in that respect is wholly at variance with the general teachings of this country in regard to the management, not only of this disease, but of the other acute infectious febrile diseases. It is, moreover, a treatment radically different from any method hitherto practiced in the other hospitals to which you have access, and is only briefly discussed in your text-books. It has now been systematically and continually carried out in this hospital during a period of sixteen months, and our studies in regard to it embrace, so far as I am informed, a longer period of time and a larger number of cases than in any other American hospital. These cases, in comparison with

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the collection of cases studied in England and by English physicians in Australia, and particularly by the German and French military physicians, constitute a very limited experience. But they are, collectively, sufficiently large to warrant a review of our work at this time, especially as our results coincide with those which have been placed on record upon a much larger scale abroad.

"The method of Brand (p. 24), treated with indifference outside of Germany, where it originated, for a long time met with violent and systematic opposition in the country of its birth. By degrees it won its way to favor, step by step, in spite of this opposition. It is now the routine treatment in the German army and in many of the French garrisons; it is much used in hospital practice in England and in Australia, and has within recent years excited widespread attention in the United States. The general testimony in regard to its effect upon the cause of the disease is in entire accord with the statement of Brand." Dr. Wilson furnishes statistics which offer abundant testimony.

"From February 1st to July 15th, 1890, under my service, *forty* cases, no deaths; average number of days in the hospital, 36.9. July 15th, 1890, to February 1st, 1891, service of Drs. Trau and Wolff, 54 cases, one (?) death from chronic nephritis, three weeks after temperature had fallen to normal; average number of days in the hospital, 38.2. February

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1st to June 1st, 1891, under my service, 66 cases, 7 deaths; average number of days in the hospital of the non-fatal cases, 26. Total cases in 16 months, 160; total deaths, 8 = 5 per cent. In the entire series of cases relapses occurred eleven times; multiple relapses once. The average number of baths in each of the first series was 42; the smallest, 10; the largest, 180. Among the deaths the average date of admission was eleven days. A proper analysis of these cases would show that from February 1st, 1890, to February, 1891, there were 94 cases treated in the German Hospital of Philadelphia, without a death, while in other hospitals in the same city the mortality in 271 cases during the same period, under expectant and mild water treatment, was 13.29 per cent.

Dr. G. C. Smythe, of Indianapolis, Ind., reports, September 15th, 1883, to the Medical Society of the Mississippi Valley, 157 cases typhoid fever treated by baths by himself and three colleagues, with 3 deaths (1.9 per cent.). He says in a later paper (Transactions Indiana Medical Society, 1889, p. 8): 'No one has a right to oppose this treatment upon purely theoretical grounds. He who does so, and refuses to adopt it, *signs the death warrant of twenty individuals out of every hundred* with this disease, and a discriminating public will hold him responsible.'"

Dr. Carl Borning, in a paper read before the Detroit Medical Association, and published in the Physician and Surgeon, December, 1889, says on

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page 2: "In reviewing 61 cases"—which he had treated without a death by Brand's method, with no medicine except one or two large initial doses of calomel—"I have to say most emphatically and decidedly that Dr. Brand's method of treating, with cold baths, typhoid fever or typhus fever, or in fact all diseases with a continuous abnormally high temperature, is the very best, the ideal mode of treatment, and the one which should be pursued in every case, may it be severe or mild, and, *if this plan is persisted in from the beginning, no anxiety need ever be felt by the physician about his patient, for he will surely recover.* The course of the disease will be relatively mild, and all those various and dreadful complications which are so common with any other plan of treatment will be almost entirely excluded. But, in order to get these results, *you have to carry out Brand's directions to the letter.*"

A work on the Hydriatic Treatment of Typhoid Fever has recently been published, which does great credit to the head and heart of its author, Dr. Carl Sihler, of Cleveland, Ohio. This gentleman was so firmly convinced of the life-saving value of the Brand method in typhus fever that he undertook, at his own expense, the work of translating Brand's, Vogl's, and Tripier's contributions (from which I have in this monograph so liberally quoted), because "here was a chance for missionary work in a field which promised many good results." The author justly says that,

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while his personal experience "covers the first period of experience with the water treatment, when serving my apprenticeship, and shortcomings and mistakes in the application of the method would be apt to make such observations of little value," it demonstrates clearly "with what degree of accuracy and how extensively an ordinary practitioner in private practice is able to follow" this method, even among the laboring classes. During two years Dr. Sihler treated 54 cases of typhoid fever with water, with three deaths, and 26 mild cases, some of which had baths, with but one death;" and concludes by saying "with this method a powerful means for good is placed in the hands of the physician, and I would no more think of placing any one dear to me personally, suffering from typhoid fever, into the hands of a physician who does not act according to the principles of Brand, than one who had to undergo an operation into the hands of a surgeon who does not act according to the principles of Lister."

Dr. Hare (Practitioner, March, 1891) reports 1,828 cases for the Brisbane Hospital, Queensland, treated by the expectant method, with a mortality of 14.82 per cent., while of 1,173 cases treated by cold bathing the mortality was 7.84 per cent. As quinine and antifebrin were also used when the temperature was obstinate to the baths, we must place these statistics among the mixed bath treatment. Dr. Hare's statistics present almost exactly the same result as

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that in the second division of Vogl's hospital, in which the same mixed treatment was pursued. They are equally valuable, because all sources of error are eliminated in this judicious report.

Bouveret records (Lyons Méd., 1891) 100 cases of typhoid fever treated by the strict cold bath, with a mortality of 3 per cent. The average date of admission of the fatal cases was the 16th day. He commences in advanced cases at 79° and 80° F., reducing the temperature of the baths to Brand's standard of 65°, if fever does not yield. *He has never had syncope or heart failure from the bath, because he never omits friction over the body*, except over the abdomen. He treats strictly in accordance with Brand's rules, except that the abdominal wet compresses are kept cold by ice-bladders, contained within them.

The following table, which I have gathered with care to exclude all unreliable statistics, presents at a glance the comparative merits of the various methods of treatment. The figures astounded me when I sought them out, and I trust they will impress the lesson they teach indelibly upon the mind of the reader. But I do not ask the acceptance of this statistical evidence alone, although it will doubtless be conceded that never in the history of medicine have statistics of such magnitude, from such reliable and diversified sources, been brought to bear upon a question of therapeutics. The profession should divest itself of the empirical influence of mere figures,

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which, it has been said, may be marshaled in any cause to prove anything, and *study the reason* why the cold-bath treatment of typhoid fever is superior to the antipyretic, expectant plan.

TABLE OF COMPARATIVE MORTALITY UNDER VARIOUS METHODS OF TREATMENT IN TYPHOID FEVER.

REPORTER.	SOURCE.	TREATMENT.	NUMBER OF CASES.	PERCENTAGE OF MORTALITY.
Jaccond.	Various sources.	Expectant.	80,140	19.25
Murchison.	" "	"	27,051	17.45
Brand.	" "	"	11,124	21.7
Delafield.	New York Hospitals, 1878-83.	"	1,305	24.66
Tripier.	Lyons Hospital, 1866-77.	"	229	26.2
Vogl.	Munich Mil. Hosp., 1841-78.	All kinds, chiefly expectant.	5,484	20.7
Hare.	Brisbane Hospital, 1882-86.	Expectant, quinine and cold wet sheet.	1,828	14.82
Wilson.	German Hospital, Phila.	Expectant and some baths.	271	13.29
Tripier.	Lyons Hospital, 1873-81.	Expectant and bathing.	629	16.5
Bouveret and Teissier.	" " 1882-87.	Strict baths in severe cases.	376	6.9
Vogl.	Munich Mil. Hosp., 1868-81.	Expectant and baths.	2,841	12.2
Brand.	Various sources.	All kinds of cold baths.	19,017	7.8
Riess.	Berlin Hospital.	Permanent tepid baths.	1,000	8.5
Ziemssen.	Tübingen Clinic.	Graduated baths and antipyretics	2,000	9.6
Vogl.	Munich Military Hospitals, 1877-87.	Strict cold baths and antipyretics.	702	7 6
Hare.	Brisbane Hospital, 1875-81.	Cold baths and some antipyretics.	1,173	7.84
Naunyn.	Kœnigsberg Clinic.	Strict cold baths.	145	6 9
Vogl.	Munich Military Hospital (2d division), 1882-87.	More strict baths and less antipyretics.	144	4.1
Vogl.	Munich Military Hospital (1st division), 1880.	Strict cold baths.	428	2.7
Vogl.	Munich Mil. Hosp., 1882-87.	" " "	141	3 5
Bouveret.	Lyons Red Cross Hosp., 1891.	" " "	100	3.
Brand.	Various sources.	" " "	2,198	1.7
Brand.	Same cases, omitting those not treated before fifth day.	" " "	2,150	0.0
Wilson.	German Hospital, Phila.	" " "	40	0 0
Trau and Wolff.	" " "	" " "	54	0.0

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In the first place, the idea that high temperature is the chief determining cause of fatality in typhoid fever must now be abandoned. The sooner we cut loose from this bugbear, the better for suffering humanity. Rather than enter upon an elaborate discussion of the present status of the question, I refer to the clear and sagacious review of the pathology of fever by Professor Welch, of Johns Hopkins University, in his Cartwright Lectures, 1888. He gives a cautious, painstaking weighing of all the evidence bearing upon the lethal influence of heat elevation in fever, sustained by experimental and clinical data that must be convincing to any unbiased mind. He says, in summing up (Medical Record, April 28, 1888):

"We find that animals may be kept at high febrile temperature for at least three weeks without manifesting any serious symptoms. The only functional disturbances which could be attributed directly to the influence of the elevated temperature were increased frequency of the respiration and quickened pulse. No definite relation could be established between the variations of arterial tension which occur in fever and the height of the temperature. Although the experiments narrated showed that prolonged high temperature is an element in the causation of fatty degeneration of the heart, they also indicated that other factors, such as infection, are concerned in the production of the lesion. Moreover, experimental evidence was found in support of clinical facts, showing

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that this alteration may exist without serious interference with the functions of the heart, so that the conclusion seems justifiable that *failure of the heart-power in fever is less an effect of high temperature than of other concomitant conditions*. The lessened perspiration, the renal disorders, and the digestive disturbances (with the possible exception of constipation) are referable also chiefly to other causes than the increased temperature. Both experimental and clinical observations strongly support the view, now widely accepted, that the disturbances of the sensorium, which constitute so prominent a part of the group of so-called typhoid symptoms, are dependent in a far higher degree upon infection or intoxication than upon the heightened temperature. Although no attempt was made to analyze in detail the clinical evidence relating to the effects of high temperature, attention was called to the fact that the absence of all serious symptoms in many cases of relapsing fever, and in the so-called aseptic fever, in spite of prolonged high temperature, strongly support the conclusions derived from the experimental study of the effects of heat upon man and animals. Even in fever, such as typhoid fever and pneumonia, where the height of the temperature is undoubtedly a most important index of the severity of the disease, there exists no such parallelism between the temperature and the nature and severity of the symptoms as we should expect if these symptoms were caused by the increased heat of the body."

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In the discussion of a paper on Antipyretics which I had the honor to read before the Section on Practice of the New York Academy of Medicine, the lamented Dr. Wesley Carpenter said: "With regard to heart failure and degeneration of the muscular fibres of the heart, I had an opportunity, in connection with the pathological department of Bellevue Hospital, to examine microscopically the cardiac muscle in a sufficient number of cases to make it quite evident that it did not occur with the frequency one might be led to expect from reading the writings of the German observers."

Dr. A. L. Loomis said on the same occasion: "I am not certain, for I have been in the line of observations similar to Dr. Carpenter, that failure of the heart is due to parenchymatous degeneration, of which we have at times heard so much, and it has seemed to me to be due to failure in nervous supply as much as to muscular changes." This is clear evidence from pathologists and clinicians, which I might corroborate by other native and foreign testimony.

Since it may be now regarded as an established fact that high temperature, minus infection, does not produce those serious degenerations formerly ascribed to it, we must seek in the infective process, and the ptomaïne-intoxication resulting from it, those deleterious effects upon the vital organs which undermine the system and eventually cause death in typhoid fever.

The cold-bath treatment yields the most triumph-

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ant results in combating these very effects of the infective and toxic agencies, with whose true entity we have not yet been brought face to face. It has been clearly demonstrated by numerous trustworthy observers that the reflex stimulus aroused by the shock to the extensive peripheral nerve-endings so energizes the nerve-centres which furnish innervation for circulation, respiration, digestion, tissue-formation, and excretion, that the system is enabled to tide over the dangers which would ensue from failure of these functions. This, in a nut-shell, is the effect of cold bathing; the simple cooling effect on the blood occupies a secondary, though not unimportant, office. In the "Rationale of the Tub Bath" (p. 43) the explanation of these effects has been fully given.

The fact, as shown by Winternitz, Quinquand, and others, is that cold baths actually increase oxidation in health, and that while the skin is cooled and the blood-vessels contracted, the deeper structures are slightly increased in temperature and their vessels dilated. As the opposite condition, viz., dilatation of the arteries and superficial vessels, evidenced by the dicrotic pulse and loss of elasticity and contraction of the vessels, with diminution of the blood pressure in the inner structures, are manifestations of the fever, the effect of the cold bath appears primarily to be directed against these manifestations, as has been demonstrated by Winternitz's sphygmographic investigations.

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The vivifying effect upon the nerve-centres referred to produces a vigorous cardiac action, which is evinced by the slower and more regular pulse and an improved tension of the vessels; it improves the appetite and digestion, enabling us to enforce a more perfect nutrition; it deepens and lowers the respiration, preventing stasis of bronchial secretions and obviating pulmonary complications; all the secretions are enhanced; the patient is refreshed and invigorated, and fights the battle of life with all chances in his favor. How different is the aspect of the case under the expectant treatment, and how different is the effect of pure antipyretic medication! The temperature may, indeed, be reduced, but the stimulating effect upon the nerve-centres and secretion, except on the perspiration, is absent. Vinay (Lyon Médical, 1888), who has made some creditable investigations on the subject, tells us that antipyrin does not relieve the delirium, which is in accordance with my own observation; it does not, like the cold bath, increase the flow of urine, by which noxious elements are eliminated. Vinay has confirmed Vogl's observation that there was a rapid gain of weight after cold baths had reduced the fever. Kairin, resorcin, and antipyrin (according to Jacubowitch, Jahrb. für. Kinderheilkunde, 1885, and other authorities) diminish the excretion of urea and nitrogen; hence they diminish the excretion of the *materies morbi* through the kidneys, while baths increase it. The liver in patients

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dying after treatment by antipyrin is from 6 to 12.50 grammes heavier than in those dying after cold baths. This is confirmed by Dr. Porter (New York Medical Journal, July 30, 1887), who found that antipyretics produced granular and fatty metamorphosis of the liver and kidneys. Indeed, there is an entire absence of good effect upon the circulation after antipyrin, an effect which is marked after the cold bath.

In the discussion of this subject, at the instance of Dujardin-Beaumetz, by the Paris Congress of Therapeutics a few years ago, Lépine stated that his investigations showed conclusively that all antipyretics, whose effect is so palpably soothing to the nervous system, act by inhibiting the activity of the protoplasm; they destroy chiefly the red corpuscles, either by converting the hæmoglobin or by attacking the cell-structure itself; they act as poison to the protoplasm. Desplats, though favoring medicinal antipyretics in fevers of short duration, favored most decidedly the strict cold bathing of Brand in continued fevers, with a tendency to adynamia or ataxia. Stokvis and Semmola spoke of medicinal antipyretics as dangerous remedies. Semmola thought that whatever comfort is induced by them is purchased at the expense of weakening the patient.

Dr. Horatio C. Wood, who, as Professor of Therapeutics in the University of Pennsylvania and author of the most able work on that subject written in this country, may be regarded as a safe counselor, says

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with reference to Brand's method: "I have no doubt that very many persons have died in the United States of typhoid fever whose lives would have been saved if the American medical profession had risen above the opposition of the laity and above its own prejudices."

Another teacher, Dr. H. A. Hare, Professor of Therapeutics in Jefferson Medical College, in his exhaustive Boylston prize essay on "Fever; its Pathology and Treatment by Antipyretics," furnishes a judicious exposition of this subject. On page 62 he says: "The writer feels sure that antipyrin should be given in typhoid and other low fevers of a continued type only when the cold pack (with which he evidently includes bathing) cannot be used, or, at the end of the cold application, to prevent the temperature from bounding upward after its depression. Further than this, the fever will sometimes resist all doses of antipyrin that we can give, or, at any rate, all that it is safe to give. No fever can resist the cold bath." Also: "Cold bathing is a power for good, before which every other measure must stand aside."

Briefly stated, cold baths are antifebrile remedies, while antipyretics are simply anti-thermic agents. Hence the superiority of the former over treatment by antipyretic medication. A mixed treatment is advocated by Liebermeister and Ziemssen. The latter, who is one of the stanchest defenders of the cold bath (not, however, as an antipyretic alone), regards the gradually lowered bath as better adapted

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to the exigencies of private and civil practice, while he concedes that the results of Vogl and others, in military practice, leave nothing to be desired. Liebermeister has until very recently insisted upon the cold bath as an antipyretic to produce remissions, and orders quinine to render these more enduring. Naunyn, on the other hand, uses a modified and more temperate bathing, rejecting all antipyretic medication.

As corroborative and explanatory of the reasons of the superiority of the bath treatment, a valuable lesson is inculcated by the reports of Dr. A. Vogl, who is the chef of the Garrison Hospital at Munich. He has collected from the records of that hospital all the cases of typhoid fever treated in it for forty-seven years, giving details of treatment, autopsy findings, and other valuable data in 8,325 cases. The gross results are noted in the table given above. But the most important deduction may be drawn from the fact that since 1875 two methods of treatment were pursued at the different stations of this hospital. In Station I the combined method, consisting of baths of temperature of the room, with 3 to 4 grammes quinine daily, and salicylate soda, was practiced; in Station II the methodical Brand bath of 60° to 65° F., for 15 minutes, whenever the temperature reached 103° F.; no medicine being used. The barracks in which this treatment was executed are so well ventilated, as I observed from personal inspection, that their temper-

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ature in winter averages about 45°. The long room is heated by iron stoves, is open near the roof, and is so well supplied with windows that it resembles a florist's hot-house. Two tubs, of ordinary zinc, stand at its upper end, under the faucet, and to these the patients are carried. Such management seems heroic indeed, but the results are astounding:

RESULTS.

	Combined Treatment.	Strict Baths.
Number of cases	667	221
Mortality	7.6 per cent.	2.7 per cent.
Average stay in hospital..	40.7 days.	47.3 days.
Average duration of fever.	1.9 week.	1.8 week.
Percentage of complications	102.0	65.2
Average number of diarrhœas per day and person....	1.9	0.7

The report of Vogl is altogether a most remarkable therapeutic statement, because it offers unimpeachable testimony to the effect upon the same type of patients (soldiers of about the same average age and condition of previous health) under depleting, nihilistic, expectant, and water treatment, and also striking evidence on the difference between a combined water and medicinal (antipyretic) method and the systematic Brand (antifebrile) method. The numbers are sufficiently large to entitle them to respect, and the long period of time during which

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these observations have been made by various independently acting medical officers must exclude all possible errors resulting either from personal bias or variations in the type of the disease.

Vogl has also confirmed the important fact, first brought out prominently by Brand, that the capacity for enjoying and digesting semi-solid food is greatly enhanced by the cold bath treatment. Drs. Geo. Peabody and Austin Flint have made the same observation at Bellevue Hospital. The former even allows solid food in the third week of the fever, and the latter has informed me that the appetites of his patients are difficult to appease since using the bath treatment. How different the condition of the stomach is under the expectant or antipyretic treatment every experienced physician knows but too well. As Brand graphically says, and I can confirm from personal observation: "While, under the water treatment, the tongue is moist, pale, without fur, the pharynx free from pain, the stomach and intestines free from catarrh, the latter only showing swollen glands, we find under other treatment the tongue hard, brown, and dry, saliva is absent, swallowing is painful, stomach and bowels utterly incapable of digesting, their mucous lining covered with ulcers, the bowels distended; and in this condition the school demands that the patient be well nourished. What a singular demand! The digestive organs are in so nearly a normal state under the bath treatment

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that I often asked myself the question if it may not be safe to give more solid food, in order to appease the hunger. I find in Virchow's Archiv. 89, pp. 95 and 303, an essay by Hösslin, who demonstrates that even in fever and diarrhœa, so long as these do not reach a very high temperature, as is usual in typhoid fever, the nutriment is almost completely taken up; that there is, therefore, no reason to give fever patients less food because it is not digested and absorbed. He regards it necessary to offer typhoid patients the largest possible quantity of concentrated food, as milk, meat, eggs, flour preparations, etc., all, however, in minced and liquefied form."

Tripier and Bouveret give bouillon, extract of beef, coffee and tea with milk, ½ pint after each bath. During the time of relative apyrexia they allow rolls, rice cream, tapioca, chocolate, four soft eggs daily, etc. As soon as the temperature is nearly normal, they allow roast chicken, bread and milk, lean meat, rice, baked brains, white lean meat, a little boiled beef, ground fine, etc. Vogl gives, from the first day, coffee, meat broth with a little flour and eggs, milk, one bottle red wine daily; later, bouillon and eggs, so that patients receive daily 50 grammes albumen, 45 grammes fat, and 200 grammes carbohydrates, a food quantum that could not be permitted to patients who are not bathed. Brand says the most important element of nutrition, besides the food, is a good stomach, and that this may be obtained by the

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systematic bath treatment. The bedside observations of the strict bath advocates are so rich in demonstrations of its beneficial effect upon all the functions which contribute to the maintenance of strength and endurance during fever, that I would fain cite them, did space permit.

I have endeavored to show as briefly as possible the reasons the results are more favorable under the cold bath treatment first suggested by Brand in 1861. The latter is thus demonstrated to be the ideal treatment for typhoid fever, and that whenever a deviation is made from it, Jürgensen's opinion, given at the Congress in London, is sustained, that "whenever he has attempted to deviate from the rigorous cold water treatment, he was compelled to return to it, in order to obtain the best results."

In the fourth Congress of Internal Medicine (1885), eminent clinicians expressed almost unanimously the opinion that "until we obtain a specific curative agent for typhoid fever, such therapeusis is to be preferred which is capable of diminishing or removing the effects of the morbific agents, and that this aim is most surely fulfilled by hydrotherapy; that medicinal antipyretics act only against temperature elevation, but do not, like the bath, produce a modifying effect upon the fever process." Fiehlene, Liebermeister, Jacksch, Strümpell, Rossbach, Heubner, Jürgensen, Bamberger, were among the speakers on the occasion, and were instrumental in producing a

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reaction in favor of the bath, which was about to be swept away in the antagonism which antipyretic medicines in typhoid fever had justly evoked.

There is a statistical bureau in Berlin which sifts carefully all statistics pertaining to medicine. In 1887 Guttstadt, who is its censor, said in a lecture before the Verein für innere Medicin in Berlin: "An important factor in the diminution of mortality is the more successful treatment now used, *especially* BRAND'S METHOD."

Ziemssen and Vogl furnish, from personal experience, a description of the beneficial effect of cold baths upon themselves when they had suffered from typhoid fever. They both testified that they should not be deterred by the protests of the patient from rigorously executing the plan of three-hourly bathing so long as the temperature is 103° in the rectum, or when the sensorium is deeply depressed with a lower temperature. Even sleep should not prevent resort to the thermometer and bath, if temperature and pulse urgently demand it.

The object of this treatment, it must be understood, is not to subdue the temperature, but to vivify and energize the vital organs, and thus insure a vigorous resistance to the toxic influences arising from the infective processes. This is the great aim to be kept steadily before us.

In presenting this apparently heroic treatment to the re-consideration of the profession, I am aware

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that there are serious objections to its general adoption, which seem almost insurmountable. The profession must be educated to abandon the policy of expectancy, whose aim it is to allow the fever to pursue its own course. The annoyance involved in the bath is not in accordance with the expectant plan, whose object it is to avoid all disturbance of the patient for remedial purposes. So long as we had only an inefficient, if not injurious, medicinal treatment, it was wise to avoid disturbing sleep. But in a severe case of typhoid fever, it is as important to disturb sleep, if due to stupor, or when the rise of temperature indicates the necessity, as it is in opium poisoning, when stupor supervenes. Indeed, the treatment is somewhat analogous, inasmuch as the object is to arouse the nerve-centres and keep them aroused (though not continuously, as in the latter) until the toxæmia has passed away.

The nurses and friends of the patient will be reluctant to adopt so active a measure. If the physician is convinced that he is right, he must insist upon his directions being followed. The idea that the reduction of temperature is the leading object of the cold bath, and the much greater facility of accomplishing this object by antipyrin and antifebrin, may deter many from adopting the former. The fallacy of this course has been demonstrated. Timid persons may be alarmed by the patient's pallor, small pulse, and complaints of chilliness while in the cold bath. But,

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if properly administered, with chafing of the body and limbs, these effects will be counteracted to some extent. Reaction after removal will soon reassure the attendant, and embolden him to order regular repetition.

A slovenly application of the bath, or the substitution of some other method—packing, sponging, sprinkling, etc.—will fail and cause discouragement. It must be remembered this is not cold bathing. A small experience, personal or from hearsay, which may have been unfavorable in one, two, or several cases, will deter some from adopting the energetic cold bathing. The only modification of the general cold bath admissible is the stimulating affusion advised by Brand in cases threatening heart-failure and delirium. This is a warm half-bath, with cold affusions over the head, chest, and back. (One important point is that the tub always be brought to the bedside, to avoid unnecessary disturbance of the patient.)

The experience with cold bathing in England and America, where it has never found favor, has been too small to afford a proper estimate of its value. Dr. Bristowe, of St. Thomas' Hospital, may be cited as an example. He says: "My personal experience in this treatment is not extensive, and for some years I have rarely, if ever, resorted to it. I have undoubtedly seen patients apparently benefited and making a good recovery, but I have never felt satisfied that the benefit was real."

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Dr. Austin Flint published, in 1882, a lecture which exercised a potent influence in this country. He treated seventeen cases in Bellevue Hospital. "In a few cases the cold bath of 80° F., gradually reduced to 65°, was employed, but was discontinued on account of inconvenience." His conclusion was that the antipyretic treatment neither increased nor diminished the mortality, which was four out of the seventeen cases. His present successor has accepted my personal suggestion on the proper method of the strict Brand bath, and is *pursuing it with success* in the same wards. If we compare these statistics with those offered by Brand and the recent American and Australian figures, their utter insignificance for purposes of deduction becomes apparent. The true clinical value of the cold-bath treatment is dwelt upon in many text-books. Strümpell's Practice, a translation of which is now used as a text-book in the College of Physicians and Surgeons of New York, may be cited. Strümpell says, with his usual fairness: "There is at present no other single method of treating typhoid fever which has so numerous and evident advantages for the patient. We regard it as a duty of every physician who undertakes to treat a severe case of typhoid fever to try his best to have the bath employed."

OBJECTIONS.

Many objections to the strict execution of Brand's method have been urged. One is the difficulty, if not

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impossibility, of treating patients before the fifth day. Indeed, this can only be done, it is claimed, in military hospitals or in epidemics. Every suspicious case may be subjected to the bath. It has been objected that "this is a very delicate adjustment of treatment when a patient is saved or doomed, according as it is inaugurated on the fourth or fifth day." This objection, if valid, would apply to much of our therapeutic endeavor. *Obsta principiis* is the first principle of rational therapeutics. Disease may properly be likened to a conflagration, the ease of whose subdual is in proportion to the stage at which it is attacked. In the severe types of malarial fever, for instance, one day's—yes, even one hour's—cinchonization may save the patient's life; its delay dooms him to death, or to long-continued invalidism. Brand has demonstrated as clearly as anything can be demonstrated by clinical data, not from his own practice only, but from that of others also, that out of two thousand cases treated before the fifth day *not one died.* The uncertainty of diagnosis here steps in to mar possible success. Before the appearance of the spots, we cannot pronounce definitely whether we have a case of typhoid fever, acute tuberculosis, gastric fever, pneumonia, acute nephritis, or one of the exanthemata. We have the satisfaction of realizing, however, that in the large proportion of cases these diseases may readily be excluded. But we may readily escape from the dilemma entirely if we adopt the rule to subject

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every case of fever whose temperature persistently marks above 103°, for several hours, to cold bathing in a mild form. Experience has taught that no harm will ensue from such a course. The systematic bath may aid us in reaching a diagnosis.

In acute tuberculosis, for instance, the symptoms will not be ameliorated, as in typhoid, and even if the bath were capable of damaging the patient's prospects, the latter cannot be done, because the disease is invariably fatal. In the low forms of the initial stage of some of the exanthemata, with high temperature, cold affusions have been found so effective by Currie, and later by Ziemssen and others, that a few ablutions or baths will surely not damage the patient's chances, but rather rescue him from the ataxic condition, and save his life. In my hospital service I have directed the house staff to do so. If the disease proves not to be typhoid, no harm will be done. At any rate, the more nearly we approach the high standard of strict bathing, the more nearly we approach the low mortality. Hence, the earlier the baths are resorted to, the more strictly they are used in accordance with the directions regarding their temperature and frequency, the more completely will the toxic processes be controlled, and the mortality be reduced.

One illustration will suffice. On November 10th, 1889, the police sent an ambulance call to the Manhattan General Hospital, for a case of paris-green poisoning which had been found unconscious on the

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street. The stomach, on being washed out, was found to contain no poison. Patient's temperature was 106° F.; pulse, 140; tongue, brown and dry; he was apathetic, and could give no account of himself. He had no cough; his respiration was not out of proportion to the pulse. Pressure in the right iliac region made him shrink. A graduated bath of 90° F. to 68° F., with occasional cold affusion, reduced his temperature to 101° F. in three hours; another bath, when it rose to 103° F., reduced it to 100° F. It never rose to the bath rule figure (103° F.). On the second day consolidation was made out in the upper posterior half of the right lung. The patient was convalescent in five days. *He was bathed on suspicion with benefit.*

Every case of typhoid fever reaching a rectal temperature of 103° should be subjected to the bath. One of my correspondents asked: "If a patient has a temperature of 104° for an hour or two every evening, but with moderate fever for the rest of the time, and without 'Functionstörung,' should you then think it necessary to insist upon the bath?" This is a question that will frequently arise in the mind of the practitioner, who would fain shrink from the trouble, annoyance, and possible criticism of the bath procedures so long as the case presents a mild aspect. It will not be difficult for the attendant to order and insist upon the cold bath, if the patient has a temperature of 105°, with delirium, stupor, etc., but when he

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appears to be comfortable, with a temperature ranging between 102° and 103°, or 104°, it does seem so glaring a violation of the long-established expectant treatment to disturb his comfort by a cold bath, that few men will have the temerity to advise it. The experienced practitioner, however, knows but too well how sadly his prognosis, derived from an early mild course, sometimes fails to be verified when, in the beginning of the third week, the first sound of the heart begins to fail, the pulse becomes rapid, the lung becomes hypostatic, hæmorrhage and perforation ensue, and death closes the scene.

We rarely witness the death of a case of typhoid in the first week from excessive temperature or from failure of the nervous system; the chief danger lies in the infective process, which undermines the system slowly but surely. To meet this danger, the cold bath is our shield and ever-ready weapon. In mild cases, the rise of temperature and pulse are readily combated by it, the resisting power of the disease being feeble. Hence, the temperature rises only at long intervals to 103° F., but, whenever it does so rise, the rule should be inexorable; the bath must be administered. Clinical experience demands it, and, if we would receive its benefits, we must obey the behest.

Is there not danger of producing lung complications by cold bathing? has been urged. This question has also been abundantly answered by clinical demonstrations. There can be no more cold-threat-

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ening conditions than exist in the Military Hospital of Vogl, in Munich. If a combination of cold air and very cold baths do not produce bronchitis, pneumonia, and pleurisy in typhoid fever, the bath alone may be regarded as free from such accusation. Vogl treats his infectious cases in barracks, which are built of wood, like summer pavilions, resting upon pillars, which support a double floor, whose ventilation is complete; the roof, ceiling, and walls are also arranged for perfect circulation of air, as I have had the opportunity to examine personally during a recent visit. During the severest part of the winter he closes the open spaces under the roof and between the floors by simply boarding up, and starts a fire in the cast-iron stoves. All the windows remain open, unless strong winds, rain, or snow-drift forbid, which the neighboring buildings somewhat prevent. The patient is only protected against direct drafts of cold air; the windows adjoining the tubs are always closed. As the entire length of the barracks consists of windows, without intervening walls, the patients practically lie in the open air. "In severe weather we rarely can raise the temperature above 0° C. (32° F.). The fear of cold and circulating air is unjustified. I am so accustomed to hear from my visitors expressions of apprehension on the point that I do not wonder that the reader feels the same. Just as I have convinced the former, so I hope to convince the latter, that a thorough lung ventilation protects against adhesive

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processes; the cooling effect of the air and increase of heat dissipation from the whole body form, together with baths, the basis of our success. An experience of ten years' conscientious observation, without prejudice, is surely entitled to consideration. I have never heard complaints nor experienced anything but benefit from the extensive and thorough ventilation of our barracks, and I feel that I have not departed from the useful. Bronchial catarrh and angina are just as rare here as in the large wards; we have never seen severe erysipelas. A very anæmic, pleuritic patient, who was sent to the barracks with a sub-febrile temperature, was transferred into the large ward when cold weather commenced. The temperature rose at once, and remained high for five days, with strong morning remission. The high temperature ceased at once upon his being returned to the barracks. The unpleasant effect upon the anæmic patient, but not upon the accompanying bronchitis, drove him back to the ward, where his temperature again rose, so that he asked to be transferred to the barracks, where he recovered. There was not a single death from pneumonia or bronchitis, and only one from pleurisy, in cases treated by strictly cold bathing and this open air method. I could cite much other testimony on this point, but none more convincing, I trust."

On the contrary, so far from producing lung complications, the numerous cases detailed *in extenso* by Brand and by Tripier and Bouveret and others go

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to prove that we have in the cold bath the most effective treatment of these complications, when they occur during typhoid fever. Only when they occur in far advanced stages of the fever, with great adynamia, the cold bath should be exchanged for that of a milder temperature and more brief duration.

The question has been asked: "Is the rule to bathe every three hours in winter, at 65° F., whenever the temperature reaches 103° F., absolute, and not to be modified to adapt it to each case?" Most assuredly, I would rarely deviate from the rule except in the beginning, when patients' peculiarities may be noted; because this rule has been established by deduction from large clinical material, carefully gathered by numerous observers in different localities, in private, hospital, and military practice. It must always be borne in mind, too, that the object of the bath is prophylactic; its aim is not a mere reduction of temperature, but a suppression of the violence of the febrile movement until it has spent its force. Whoever expects to throttle the fever by the bath will surely be disappointed, for its course is as steady and inexorable as any law of nature. The temperature will almost invariably fall from one to three degrees after each bath, only, however, to rise again to within a fraction of its former rate when three-hourly examination is made. But from day to day there will be a gradual, yet steady, diminution of the average temperature, which indicates that the resisting power of

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the system is gaining sway over the disease. This is the usual effect of the systematic cold bath, administered without fear and without favor. Whenever we attempt to substitute another form of hydriatic procedure, to raise the temperature of the bath water, to shorten the duration of the bath, or otherwise to change the rule, we must expect a change in the result. If the case comes under treatment late, the resisting power of the disease will be greater, hence the result of the bath will deviate from that here depicted. The type of severity of the disease, too, will exert its influence upon the latter. If the temperature fails to be favorably influenced by the systematic baths at 65°, a lower temperature for a more brief period, not below 60°, will be found useful in the first two weeks of the disease. Occurring later, a persistently high temperature will probably be due to complications, in the *prevention* of which the systematic cold bath has far more influence than in their *treatment*. One point should be ever present in the mind of the attendant, viz., the chief aim of the cold bath is to endow the system with power to resist the disease; hence, it is all-important to begin it early, and not to expect so much, though still a considerable effect, from it, when the disease has already made decided inroads upon the blood and the vital organs.

EFFECT UPON COMPLICATONS.

The salutary effect of the cold bath in preventing certain complications has already been referred to

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in Vogl's statistics. A more detailed consideration may serve to complete this review of the subject.

It has been asserted that the cold bath increases the tendency to intestinal hæmorrhages by driving the blood from the periphery to the enfeebled intestinal vessels. Tripier and Bouveret met only four cases among 233 thus treated; of these two died, and none showed any connection with the bath. They conclude that their own experience proves that intestinal hæmorrhages are less frequent under hydriatic treatment. Brand, who has studied every phase of this subject with an eye single to the elucidation of the truth, has sifted the histories of hundreds of cases for this purpose. He has gathered 4,995 cases of typhoid fever, in which 155 hæmorrhages were noted, 35 dying from the latter. Hence, the frequency is 3.1 per cent., and the mortality 0.6 per cent. On the other hand, among 4,890 cases not treated by water, he discovered hæmorrhages 271 times—5.6 per cent. Goltdammer, who is not so warm an enthusiast on the efficacy of strict cold baths as Brand, furnishes larger statistics (nearly 20,000 cases), from which he concludes that the cold bath has no influence in producing intestinal hæmorrhages. Vogl noted among 251 cases treated by the strict cold bath only two cases of bloody stools. All evidence, therefore, tends to prove that, so far from being influential in the production of hæmorrhage, the cold bath actually renders it less rare and

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more mild and tractable, if resorted to very early in the disease.

"That the alteration in Peyer's glands will not go beyond the stage of infiltration, if treatment is instituted before 'the fateful fifth day,' is another prediction that raises dubious questionings," says a writer in the Medical Record. I reiterate the reply made to this doubting Thomas, because it is a doubt which is but the legitimate offspring of the experience with the expectant treatment hitherto in vogue. Fortunately for the patients, but unfortunately for our pathological enlightenment, the opportunities for autopsy are exceedingly rare in cases treated by the strict cold bath. Only two cases, in which death occurred from other causes, but which had been bathed before the fifth day, furnish evidence on this point. One case is reported in Lyon Médicale, No. 14, 1886, and another by Brand in 1883. In the former, dying on the twenty-first day of a typical typhoid, there was found no loss of substance, old or new, in the intestine. In the latter, also on the twenty-first day, no ulceration, cicatrix, pigmented spots; only fresh infiltration. "If diarrhœa, meteorism, hæmorrhage, and a dry, red tongue are indications of ulceration of the intestinal glands, the absence of these symptoms in the large proportion of cases treated by the strict cold bath must be accepted as logical evidence of the absence of ulceration." Vogl's testimony on this point is strikingly conclusive, and must carry conviction, be-

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cause it emanates from the comparative experience of many years in the same class of patients—soldiers. He says: "The diminution of intestinal symptoms is a very evident effect of the cold bath; a few trials will convince and surprise anyone of its success. Among 221 cases there was a daily average of only 0.7 per cent. of diarrhœal stools; while in the cases treated with a combination of baths with medicinal antipyretics, the average was 1.9 per cent. of diarrhœa. Never was it necessary (in 251 cases with carefully written histories) to resort to opium and bismuth; meteorism, with tense abdominal walls, was observed only in cases received late; it was diminished by the baths. If inappropriate diet is capable, as we know, of aggravating the intestinal symptoms, and if proper diet is capable of preventing or ameliorating them, is it unreasonable to accept the proposition that the process influences favorably the local process, which is but one of the manifestations of the general infection?"

Pleurisy offers an indication for cessation of the baths, because it demands rest. If, however, the temperature be persistently high, with nervous symptoms threatening, these must be combated by the bath, even though pleurisy be present. Brand has never observed pleurisy in his 335 cases; Rolet, in 1,005 cases, only four; Mollière, only one in 234 cases. According to Betke, the mortality from this complication, which is rare in the cases treated by the bath, is only 0.20 per cent. in 5,075; while in 1,420 cases

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treated medicinally it was 1.4 per cent. I have had one death from it in the Manhattan Hospital.

Severe cough and paroxysms of dyspnœa are not rare, when patients feel the first shock of the bath. But these symptoms soon subside. Tripier and Bouveret mention five cases in which it persisted so as to require cessation of the baths. In some cases the oppression of breathing is voluntary; the patient either imagines it, or he simulates it in order to alarm the attendant and prevent a continuation of the bath. By re-assuring such patients their apprehension may be overcome. If cyanosis and syncope occur, the bath must be discontinued, but in severe cases this should not detef us from renewing it. The graduated bath, or the wet pack, sometimes helps these cases. The cough produced by the shock from the cold water is advantageous, as it relieves the bronchial tubes of mucus, and stimulates pulmonary circulation.

Hoarseness does not forbid the bath, but *œdema of the glottis* and *pericarditis* demand cessation.

Collapse is a contra-indication to the strict cold bath, but may be effectively met by the warm half-bath with cold affusions, as elsewhere described.

Syncope and fainting have been charged as causes of death due to cold bathing. A large experience readily disposes of this bugbear. Death from sudden heart-failure is not an unusual occurrence in typhoid fever; the cold bath is, as I have shown, the best weapon against it. Körber has shown that in 874

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cases of typhoid, treated by cold baths, only 10 died immediately after the bath, and these were very desperate cases. "What may be especially dwelt upon is the fact," says Vogl, "that in thousands of baths not a single time was collapse to be observed, either before, during, or after the bath."

Albuminuria, infectious nephritis œdema, are not only not a contra-indication to baths, but they are of the greatest value in these complications; they favor diuresis and relieve the kidneys. Only when extensive œdema or anasarca occurs, which renders it difficult to handle the patient, should the baths be discontinued.

Vomiting and colic pains are not rare; they offer no bar to the bath, unless following invariably after it.

Perforation and peritonitis strictly forbid the bath, because the latter involves disturbance of rest, which is one chief therapeutic resource.

The claim that these serious complications are sometimes due to the bathing has not only been refuted by abundant and convincing statistics, with case histories, but the fact has been established that they have been reduced in frequency. Murchison's statistics of 1,271 cases give 196 cases of perforation (11.38 per cent.). Brand's 4,884 cases give 12 perforations (0.24 per cent).

Intestinal hæmorrhage, when severe and accompanied by general symptoms, such as pallor, small pulse, cold extremities, subnormal temperature, for-

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bid the continuance of the bath. A slight discoloration of the stools need not deter the attendant from continuing the baths. Brand has continued them in six cases with good effect, and I have seen no harm from them in one case. Brand distinguishes the congestive hæmorrhage which occurs mostly before the 15th day, and which does not forbid the bath, from that occurring later and due to diseased action in the blood-vessels proper. If the hæmorrhage is pronounced, rest is imperative, and this alone requires abstention from the bath, which, however, may be again resumed, so soon as the hæmorrhage is stayed, if the intensity of the fever demands it. Indeed, this should be a rule in all cases in which the bath has been suspended for cause, for to it we may intrust the invigoration of the patient, which alone can tide him over the ever present dangers due to the fever processes. Free perspiration does not contra-indicate the bath. The patient should be dried with friction before being placed in it.

Bedsores forbid the bath (if large), because disturbance of the patient interferes with a strict antiseptic treatment. General ablutions and cold compresses should be substituted.

Erysipelas does not present a reason for discontinuing baths, so long as there is no extensive destruction of tissue accompanying it.

Late cases, viz., cases coming under treatment after the second or third week, do not forbid the bath,

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although they require a more cautious application and higher temperatures. The effect of these baths will not be striking, and the prognosis can not be expressed as being so favorable. Hospital histories demonstrate that many desperate cases, which under medicinal or expectant treatment were lost, now recover under judicious hydriatic treatment. The condition of the heart is the chief index to the bath, or rather to the kind of bath. To react from a bath of 65° F., a certain integrity of the central nervous system and of the heart-muscles is required. This is almost surely impaired by a long continued febrile process, even if no actual organic degenerations have been developed. Hence the graduated bath of Ziemssen or the wet pack is more applicable, or a warm bath with cold affusions, followed by friction. These may restore the lost stamina and enable us to resort to the cold bath, if the symptoms demand it.

In a case which I had the pleasure of seeing with my friend Dr. Rodenstein lately, there was muttering delirium, picking at the bed-clothes, subsultus, and stupor. I advised a bath at 70° F. for 15 minutes, with affusions over the head and shoulders at 60° F. The patient being well advanced into the third week, only four baths were required to reëstablish a favorable condition, which led to recovery.

The analogy between the treatment of typhoid fever by strict cold bathing and the treatment of severe types of malarial fever by quinine is so striking

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that I desire to call attention to it, in order to illustrate the necessity of precise attention to detail. Any one who has, like myself, treated a large number of cases of the severe types of bilious, remittent, and congestive fevers on the Southern river-banks, has realized how important it is to cinchonize the patient at the earliest possible moment, in order to prevent the recurrence of the paroxysm, which brings parenchymatous changes in its train. When the latter are once established, the fever continues, despite the best directed administration of quinine. The antagonistic specific effect of quinine is no longer required; we have a hepatitis, a gastritis, or splenic enlargement to treat, with which we are unable to cope successfully. But, if the malarial element be not wisely met by quinine, the patient will surely die from the combination of the malarial and parenchymatous diseases. So it is with typhoid fever. The cold bath represents the effect of quinine in malarial fevers; although it has not the specific antidotal effect, the cold-bath, applied in the early stage, has the same prophylactic effect in preventing parenchymatic degenerations. If the latter have occurred, by reason of the neglect of the cold bath, we are called upon to meet them by stimulants, rest, etc; but at the same time we may resort with advantage to some modification of the bath as a potent auxiliary.

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SUBSTITUTES.

One of my correspondents has asked an opinion regarding the substitution of the cold-pack for the bath. "What theoretical or practical reason," says she, "is there for considering (at least until tried in the individual case) that the cold-pack, repeated every ten minutes for a time, will not act as an antipyretic and stimulant as successfully as the bath?" There are both theoretical and practical reasons to establish the inferiority of the pack. As an antipyretic, the cooling effect of the pack is limited to the first few minutes; the vessels are rapidly contracted by the shock to the peripheral nerves; the cooled blood is sent to the interior only until reaction is established. Now, however, the sheet surrounding the heated body rapidly absorbs its heat; there being no accession of cold, as in the bath, the now dilated superficial vessels do not receive cooled blood to carry to the interior, as in the cold bath. A second pack is required. The patient, now warm, his superficial vessels dilated far better than in the cold bath (with friction), is wrapped again in a sheet wrung out of water at 60°. The stimulating effect is pronounced; the patient is refreshed; the blood, cooled for a few minutes on the surface, rapidly diffuses its lowered temperature in the interior. But very soon equalization of temperature between the body and sheet takes place, which, according to experiment, requires about

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ten minutes. A third and a fourth pack must be resorted to, each one reducing the temperature slightly by the process indicated. Liebermeister has demonstrated by actual trial that four successive packs, of ten minutes each, reduce the temperature only as much as a cold bath of ten minutes. Hence it would require about five or six packs, lasting over an hour, to produce the same effect of one of our 65° Brand baths of fifteen minutes. Aside from the trouble and time, the disturbance of the patient involved in six packs, even if we grant the antipyretic result, the stimulating effect cannot endure, unless the superficial vessels, relaxed as they are by the last pack, are again made to contract by a cold half-bath or ablution. It is a well established principle in hydriatic procedures never to administer a wet-pack without following it by a cold half-bath or some substitute for it, because the object for all cold hydriatic procedures is reaction, and consequent tonic effect.

The suggestion of my correspondent, however, is not without value, for the wet pack, not well wrung out, is a valuable auxiliary to treatment in those cases in which, by reason of great debility or marked antipathy to the cold bath, or any unpleasant effect of the latter, a substitute is required, as will be shown later.

In children under ten years old, the bath at 65° should be administered with caution, beginning with 85°, and gradually lowering the temperature of each

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bath to ascertain the reactive capacity and resistance of the fever. In these patients the wet pack and graduated bath are valuable auxiliaries.

It will be observed that, while the rule to bathe every case of typhoid or suspected typhoid regularly every three hours, in water at 65°, whenever the body temperature reaches 103° in the mouth, is to be rigidly followed, there are conditions referable to the patient, or to the type and stage of the disease, which in hydriatic treatment demand as judicious modifications as in every other valuable therapeutic application. On the other hand, the more thoroughly we become familiar with the cold-bath treatment, the more rare will be the apparent indications for modifying the temperature or quality of the bath. An accumulated experience will develop a remarkable universality of the rule.

It has been commonly supposed that Brand's rule is inflexible, and it has for that reason been condemned. That this is an error may be gathered from the following extract from a letter received on February 15th from Dr. Brand. Referring to a case where the bath treatment had been detailed in one of our journals, he says: "By following my rule is not understood such treatment as was given by Dr. —— to the child, which was so far reduced in strength and nerve power that it should not have been put into a cold bath, but into a warm one, until it gradually became accustomed to the cold, for twenty hours. To me it

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is surprising that Dr. —— did not obtain greater disadvantage from the low temperature used in this case; it was a special piece of good luck. *I always use warmer baths for twenty-four hours, usually of the room temperature, if the patient has been ill over four days; often, also, from the beginning.*" [The italics are mine.] From this extract it will be evident that Brand does not advise plunging every case into a bath of 65° F. without regard to individual condition. The truth is that in no method of treatment is good judgment more necessary than in the management of typhoid fever by the cold bath. Failures are constantly reported and attributed to the cold bath, when the real cause lies in its improper and faulty application.

A slovenly application of the bath, or the substitution of some other method, dictated by the fancy or inventive genius of the attendant or by his fear of cold water, must fail and cause discouragement. A small personal experience, or information obtained from hearsay, which may have been unfavorable in one or more cases, may deter some from adopting cold baths. An intelligent hospital physician, professor of pathology in a large medical school, informed me that he was prejudiced against it because in his early career he witnessed, while serving as hospital interne, the death of a patient who, being wrapped in a sheet, was placed upon a Kibbé cot and sprinkled with ice-water! This method is not, so far

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as I am aware, recommended in typhoid fever by any author. It seems to be a modification, erroneously believed to be a milder form, of Currie's cold affusions, in which the stimulus produced by the impingement of a forcible stream of cold water upon the naked skin favors rapid reaction, with its resultant stimulation of the nerve-centres. The effect of such an ice-water pack must be to produce a cutis anserina, contracting all the peripheral vessels to the utmost, and driving the blood within. An elevation of the temperature must ensue, due to the compensating effects of the heat-regulating centres, and the prevention of heat-dissipation by the cutis anserina. As the superficial cooling penetrates as far into the mouth or rectum as the thermometer can reach, we may thus obtain a false impression of the true internal temperature.

I doubt not that Duschek's bad results, reported by Dr. Krügkula in the Archiv. für klinische Med., Bd. 3 and 4, may be traced to a similar faulty method. Dr. Krügkula reports "60 cases of typhoid fever treated by cold baths, with a mortality of 28.3, while of 26 cases treated by other measures, only 26.9 died," and that "the bath treatment had no influence upon the final issue, the complications, and the duration of the disease." Let us analyze what Dr. Krügkula calls a cold bath. In this clinic "patients were laid into a bath of 60° to 65° F.," without friction, "for ten minutes." This was continued from 6 A.M.

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to 10 P.M., only when needed to reduce the temperature. The deleterious effect of this faulty method is self-evident to anyone who has followed me in the study of the *rationale* of the cold bath.

The resort to the cold bath after failure of other measures as a last resource is a fatal error, not only for the patient, but for the method. I have heard one of the ablest teachers of medicine, a physician to two hospitals, say in a discussion: "When antipyretics fail to reduce the temperature, the cold bath (not specifying temperature and duration) is useful." Useful, indeed! When a man has nearly starved to death, bread is useful. But it often comes too late to restore vitality lost beyond reach.

I have heard another teacher and hospital physician declare in the Academy of Medicine that he had not found the cold bath of value in typhoid fever. I happen to know his treatment of one case to be placing the patient upon a covered table, wrapped in a sheet, and soaking the latter in ice-water poured from a carriage sponge. She died, although her temperature was reduced from 106° to 101°. Why will men persist in modifying Brand's method until nothing is left of it but the water, and then claim that it fails in their hands?

SUCCEDANEA FOR COLD BATHS.

Under certain conditions, it may be impossible to adopt the strict bath treatment. Some of the substitutes for it have been referred to in the descrip-

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tion of the technique. With timid patients, or when the latter are under the control of timid people, whose abhorrence of cold water must be conciliated, a mild hydriatic procedure, beginning with an ablution and ending with the sheet bath (see description), may, by its beneficial effects, overcome objections. The sheet especially forms a valuable substitute for the bath in country districts where tubs cannot be obtained. When linen sheets are not available, linen tablecloths, or even old, well-worn cotton sheets, will suffice. (See description.)

In a recent case which I had the pleasure of treating with Dr. Frank H. Daniels, in private practice, the value of this bath was well illustrated. The patient, a young student, coming under our observation on the seventh day, with a morning temperature of 105°, delirium, etc., presented on the eleventh day an enormous crop of spots. Finding it difficult to obtain a six-foot tub for the tall boy, the sheet bath was thoroughly applied every two hours at 65°, with local affusions of 60°, with the result that, with continuous wet abdominal and chest compresses, only four tub baths were required to subdue the main force of the fever. He had a normal temperature on the twenty-second day, and made an uninterrupted recovery.

There is one method of bathing, which has been briefly referred to in the preceding pages, but which is entitled to a more extended consideration in this

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connection on account of the great repugnance to cold bathing existing among the people. I refer to the so-called *permanent bath*, which is claimed to have been instrumental in reducing temperature and abbreviating the duration of the disease.

PROLONGED WARM BATHS.

As has been stated above, Dr. L. Riess, of Berlin, has introduced the prolonged bath (called also permanent) for the treatment of typhoid and other fevers, with such an array of statistics and clinical data that the consideration of this method becomes imperative. The latter consists of immersing the patient into a bath of 88° F., prepared as has been already shown (see description), with a hammock to afford comfortable support. This he advises to be done whenever the rectal temperature reaches 102° F. The patient is allowed to remain in the bath usually during the day only, but, if necessary, day and night, until his rectal temperature registers 100° F. He is now removed, and again placed in the bath when he registers 102° F. If the temperature falls too slowly, or rises in the bath, an occasional short bath of 60° F. or a moderate dose of antipyrin was slipped in. This method is certainly much more free from trouble and more agreeable to the patient, when he becomes accustomed to it, than the cold bath, and may thus be substituted for the latter in some instances.

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Riess holds (Monograph from author and Archiv. für klin. Med., 1889–1890) that the original views of treatment in which temperature reduction was the chief object have been abandoned, at least so far as the methods connected with cold baths are concerned. But this in no way argues against the value of his permanent baths. On the contrary, he claims always to have held that elevation of temperature is not the essence of fever, but only its chief symptom, and that the direct influence of the organic disturbances is quite as important. The ventilation of the question seems, according to Riess, to have lessened the estimate of temperature-reducing measures with some physicians, so that many regard it as possible to substitute for these, the purely expectant, methods. Many of these, which claimed to further the practical use of antipyrin (see Naunyn, Archiv. f. klin. Med., xviii) have damaged the cause. He found antipyretics useful for reducing temperature, but they did not influence other symptoms. Hence, he returned to baths which would slowly but permanently abstract heat. He appeals to his clinical results, 809 cases treated in the Allgemeines Krankenhaus zu Friedrichshain. Although a mortality percentage does not prove much, because many hospital cases could not be saved by any treatment, he does claim that he can show the lowest mortality of any hospital in the city, and in his own hospital the mortality has been reduced from 10 per cent. to 8.5 per cent.; 12 deaths were caused by

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pneumonia, 4 by hæmorrhage, and 10 were uncomplicated. The duration of his cases was decidedly influenced, he claims, contrary to the accepted doctrine with regard to the course of typhoid fever. Although most cases came in after the 8th day, the average stay was 17.9, including 740 cases that recovered. Three hundred and one cases, coming in before the 6th day, remained 15 days; the others, 17.7. In 341 cases, which came in before the 6th day, the duration of fever averaged 15.5 days; admitted later 399 cases, averaged 19.9 days; certainly a much shorter average duration than is usually observed in so large a number of cases. Among the deaths there were ten uncomplicated, 18 with pneumonia, 12 severe throat affections, 12 perforations, 3 intestinal hæmorrhage, 3 purulent pleuritis, 3 chronic pyæmia during convalescence, and the remainder are one each of gangrenous phlegmon, gangrene of the lung, noma, hæmorrhagic nephritis, dysentery, pelvic tumor, and old heart lesion.

Hence, only 1.2 per cent. died without some complication; 34 per cent. of those dying were admitted before the sixth day of illness, 65.2 per cent. after the sixth day, the average date of the admission of the fatal cases being, therefore, 9.5 days after inception of illness. The effect of this treatment upon individual symptoms must be carefully studied. Upon the cerebral disturbances these prolonged baths seemed to act more favorably even than

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short cold baths. If this had not been the case, it would have been impossible to detain somnolent and delirious or violent cases in the bath without a much greater number of nurses. The fact was, however, that these cerebral symptoms receded without exception after the first prolonged bath; the actual status typhoidus disappeared permanently on the second or third day.

Influence upon the circulation was also favorable. Only during the first ¼-hour did the heart-action seem embarrassed, the pulse becoming small. And this should be remembered, not to discourage the attendant, because it very soon becomes stronger and slower.

Lung complications were never aggravated, but, on the contrary, improved, and rarely occurred in cases admitted early. The intestinal lesions, too, were favorably influenced; diarrhœas diminished so rapidly that they never interfered with the continuance of the bath. Complications were diminished. There were only 2.6 per cent. intestinal hæmorrhages, and 1.6 per cent. of perforation peritonitis, one of which recovered. There were 5.5 per cent. pneumonia, 2.1 per cent. throat affection, and other complications or sequelæ were very rare. Only furuncles and subcutaneous abscesses were increased somewhat (3.4 per cent.). Riess concluded, therefore, and with justice, that the treatment of typhoid fever by the permanent baths has an especially favorable effect because it does not

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reduce the temperature rapidly, and does diminish the severity of other symptoms, shortens the duration of fever, and reduces the mortality to a low point. Riess furnishes in connection with this essay, read before the Science Congress at Heidelberg in September, 1889, six temperature charts, which graphically illustrate the method and results. I select two of these, giving the temperature and duration of baths and remissions. Hebold, a bricklayer, 45 years old, was admitted on the sixth day of typhoid, with a temperature of 104° F. He was in the bath 13 hours, and removed when he reached 98° F.; out of bath 13 hours; replaced at 101.6°, etc.

OUT.	TEMP.	BATH.	TEMP.	OUT.	TEMP.	BATH.	TEMP.	OUT.	TEMP.	BATH.	TEMP.
	104°	13 hrs	98°	13 hrs	101.6°	5 hrs	99°	6 hrs	101.8°	4 hrs	99°
5 hrs	101.6°	5 "	99.1°	5 "	101.6°	5 "	99.3°	7 "	101 6°	6 "	99°
4 "	101.6°	7 "	99°	7 "	99°	5 "	99°	6 "	101.8°	6 "	98.5°
6 "	101.6°	6 "	99.6°	6 "	100.6°	7 "	98.4°	6 "	101.6°	8 "	99.2°
9 "	101.6°	5 "	99.6°	18 "	101 8°	7 "	98.2.	23 "	101 6°	7 "	97°4°

This case was continued until the fifteenth day, from which time he remained normal.

Case of Huthe, laborer, æt. 73:

OUT.	TEMP.	BATH.	TEMP.	OUT.	TEMP.	BATH.	TEMP.	OUT.	TEMP.	BATH.	TEMP.
16 hrs	104.2°	11 hrs	97 5°	5 hrs	102.4°	4 hrs	97.9°	4 hrs	101.6°	5 hrs	99.2°
3 "	103.8°	7 "	98.4°	4 "	102.4°	11 "	97.4°	3 "	101 6°	3 "	101.6°
18 "	104°	8 "	97.6°	9 "	101.6°	6 "	97.4°	17 "	102 4°	8 "	98.8°
refused											

He now (from the thirteenth day of the disease to the fifth day of treatment) remained normal.

It will be evident that this method of bathing

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has a future. It seems to be more free from trouble and annoyance to the patient and attendants, and it is not difficult to execute. My personal experience with it in acute diseases is limited to one case of sub-acute bronchitis in a boy, one case of typhoid fever, and one case of acute bronchitis, in which it acted well, and demonstrated its practicability. I propose to utilize it further at the first opportunity.

I am disposed to believe, from the experience of Brand, Vogl, Jürgensen, Wilson, and my own, that of the 34 per cent. of those dying who had been admitted before the sixth day of illness, most, if not all, would have been saved by strict cold bathing; and a large proportion of the other cases (averaging less than ten days ill when admitted) might have been saved. Still, the results are so far better than those of the fatal expectancy that it seems ungrateful to this courageous and original clinician to cavil at his excellent results.

SUMMARY.

The reader who has patiently followed me in the somewhat elaborate description of hydrotherapy of typhoid fever may claim, with justice, that he possesses an *embarras de richesses* which renders it difficult to select. Briefly stated, we have the following methods:

The strict cold bath, or Brand Treatment—a bath at 65° F. for fifteen minutes, whenever the temperature reaches 102° *in recto*. The statistical result

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(reduction of mortality to 2.7 per cent.) corroborated, as has been shown, in various countries, declares this to be the treatment *par excellence* of typhoid fever. But if, for any reason, this bath cannot be systematically given, or if the attendant is not convinced of its necessity, recourse may be had to Ziemssen's method.

Ziemssen's graduated bath; water at 90° F., gradually reduced to 72° for half an hour. Ziemssen especially recommends these baths as most useful in private practice, and, after an experience in several thousand cases during twenty years, he orders the temperature according to the patient's condition. In a weakly, nervous female, for instance, in the second week of a neglected typhoid, only warm baths of 88° to 92° should be risked, with probably a brief cold affusion or pack. The temperature of the water may then be reduced, if the effect is satisfactory, and the number of baths increased. The sum of all the symptoms and the influence upon the entire case, and not the temperature effect alone, should be the guide.

The statistical record of this treatment was in the Tübingen University Clinic from 1877–1887, in 2,000 cases—a mortality of 9.6 per cent.

The prolonged warm baths of Riess offer a valuable substitute, the statistical evidence being *more favorable* even (mortality of 8.5 per cent.) than in the Ziemssen bath, and certainly less troublesome and distressing to the patient and attendants.

Many eminent clinicians exercise judgment in

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selecting from these methods a procedure which combines mildness and efficiency. Prof. Fürbringer, of Berlin, for instance, orders, whenever temperature exceeds 103°, a bath of 90° every three hours, sometimes reduced to 86°, or even to 77° F. In feeble conditions, a bath of 96°, with cold affusions. When nervous symptoms are not pronounced, he waits with the baths until 104° F. is reached.

This cautious method does credit to the eminent clinician, especially as his cases are usually admitted late. This is the cause of his serious complications, in which even this mild treatment judiciously applied seemed to triumph, for his cases are of the most unfavorable quality; many patients are only "unloaded into our institution for the purpose of dying." Three cases only out of nine of intestinal hæmorrhage proved fatal, and three undoubted intestinal perforations, with peritonitis, recovered. His mortality in 155 cases was 10 per cent. Goltdammer is an advocate of still milder water treatment, relying chiefly upon nutrition, and regarding the cold bath as a secondary measure. His mortality in 72 cases was 20 per cent.

The difference between the timid bath practice of Goltdammer and the bold practice of Brand, Vogl, Jürgensen, Glenard, and J. C. Wilson determines precisely the difference in their mortality and complication percentage. The physician whose object it is to render the patient comfortable—to placate the disease,

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as it were—will be content with cold sponging. The inadequacy of this method has been exposed by Peabody. It does not prevent complications nor moderate the course of the disease. The physician, whose chief goal is the reduction of temperature, will resort to cold compresses, the ice coil, iced air, and to an occasional bath, with the addition of medicinal antipyretics. This method has been proved utterly inadequate by statistics.

If, as those most experienced in the method are agreed, our therapeutic efforts should be in the direction of maintaining the systemic functions, we have in the methodical cold bath the most effective means, because it not only reduces the temperature, but it refreshes and vivifies the nerve centres, which preside over the functions upon whose integrity depends the nutrition of the patient.

In closing this somewhat lengthy review of typhoid fever management, the author would call attention to the fact that he has endeavored to present the subject fairly, imbued with the solemnity of a task which may be the means of saving large numbers from the fatal grasp of the relentless scourge. The evidence before us is clear and incontrovertible. Upon our conscientious, unbiased, and fearless judgment and action rests the weal or woe of those who commit their lives into our keeping.

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CHAPTER VII.

CLINICAL ILLUSTRATIONS.

The limits of this volume forbidding a detailed discussion of the practical application of water in diseases, the following summary must suffice, in addition to what has already been referred to under the various headings:

Pneumonia.—In this disease cold baths have been lauded by Jürgensen (Volkmann's Sammlung), who has, however, found few imitators of his heroic practice, viz., baths of 70° to 60°, with large quantities of stimulants to counteract cardiac depression. Dr. Vogl, Chief of Munich Military Hospitals, has in a written communication informed me that he has found the baths, as applied in typhoid fever, of great value in pneumonia. Being a very careful and conscientious clinician, however, he is unwilling, upon the strength of only a few hundred cases, to furnish practical deductions. The gentlemen who report therapeutic successes, sweepingly condemning cold baths in this or that disease upon results derived from a few cases, may here draw a valuable lesson of caution. This has been the author's reason for withholding, in this work, his own experience as an argument wherever larger statistical material could be brought to bear upon the subject from other sources. In the croupous pneumonia of children my experience has been sufficiently large to warrant the deduction

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that we possess in the cool bath, 95° reduced to 80° for fifteen minutes, with friction during the entire bath, a means of aborting the disease if seen early, and hastening resolution if seen late. One case may be cited as an illustration of the method pursued:

Croupous Pneumonia.—Edith G., æt. 11, was seen Jan. 4, 1890, with pneumonia of posterior upper third of left lung. Temperature ranged from 102° to 104°; disease spread over entire posterior portion; respiration greatly embarrassed. The disease passed through second stage, resolution beginning on January 10th. This was proceeding well when, on the morning of January 11th, her temperature ran up to 104°; respiration, 45; pulse, 140. She became cyanotic. The upper portion of right lung now presented fine crepitant râles. Ordered ammonia carb. and digitalis and stimulants. Poultices which had been used were extended to entire back. Dr. A. Jacobi saw her in the afternoon, and advised oxygen inhalation to remove impending suffocation. On the following day at noon her condition was still more serious, breathing being greatly embarrassed; she had not slept during the night. Dr. Jacobi saw her in the afternoon and agreed with me that the case looked exceedingly desperate. We agreed to give her a tub bath of 95°, reduced to 85°, for twenty minutes. Temperature before bath was 106°; respiration, 60; pulse, 160. A severe diarrhœa had resulted from the carb. ammonia. Her face was bathed in ice-water

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before she was carried to the tub. Gentle reassurances overcame the anxiety of the patient while in the tub, before entering which she had brandy, ʒ ij. On being removed, somewhat shivering, she was wrapped in a linen sheet and covered with blankets.

She fell asleep, and was not disturbed for two hours. The breathing became less labored; she resumed her sleep after clothing was changed and poultice reapplied. Six hours after the bath the temperature was 101°; pulse, 150; respiration, 48. On the following day Dr. Jacobi was unable to see her; the temperature rose in the afternoon to 103°. A bath of 95° reduced to 90° was given, with the result of rducing the temperature to 102°; respiration, 30; pulse, 120. Stimulants and nourishment were continued. The case progressed favorably from that time, the most striking feature being that the right lung, which was last attacked, immediately began to clear up, and was entirely free from all râles four days before the left lung. This case, being carefully observed, affords an undoubted evidence of the abortive power of the bath when used in the earliest stage.

The following case from the New York Juvenile Asylum is also interesting, the record being made by Miss Wald, in charge of the hospital:

Thomas Lazarus; age, 12 years; pneumonia in left lung, posterior; admitted April 5th; temperature, 103½; respiration, 36; pulse, 128. Ordered: Calomel, grs. iv; Rochelle salts, ʒ iii. At 1 P.M. bath for

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20 minutes, 95° to 85°. Before bath: Temperature, 105½; respiration, 60; pulse, 132. After: Temperature, 101½; respiration, 64; pulse, 112; and patient's condition during afternoon poor; face and finger-tips cyanosed; extremities cold; breathing shallow and difficult. Ordered whiskey, 3 ii every two hours; tr. digitalis, gtts. iii, every quarter.

4.30 P.M. Temperature, 105½, but condition still too low to risk moving.

7 P.M. Placed in pack, 60°, for one hour; then rapidly sponged off, and temperature unaltered; bath given as before but 15 minutes. Before bath: Temperature, 105½; respiration, 56; pulse, 140. After: Temperature, 100¼; respiration, 44; pulse, 122. Bath repeated at midnight, and not long after the patient fell asleep; general appearance improved.

April 6th: Baths for 20 minutes given every four hours; much quieter.

April 7th: Baths at 5 A.M. and 8 A.M. After reacting fairly well from latter, about 9 A.M. condition changed, face assuming pinched expression; cyanosis, marked; pulse faint and thready, and breathing shallow and husky. Gave carbonate ammonia, gr. i; tr. digitalis, gtts. iii; and whiskey in repeated 3 i doses; under which he improved. Bath at noon and 4 P.M. Before bath: Temperature, 106⅛; respiration, 72; pulse, 152. After: Temperature, 104⅜; respiration, 52; pulse, 128. Cough when painful is quieted with small doses of morphine.

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April 8th: Appearance brighter; easier breathing. At 6 P.M. highest temperature; bath given. Before bath: Temperature, 106½; respiration, 58; pulse, 136. After: Temperature, 103⅜; respiration, 48; pulse, 128.

April 10th: Breathing labored and irregular; compresses, 60°, to chest, changed every half-hour.

April 12th: Compresses removed at 7.30 A.M.; by noon respiration 72, when they were resumed; by 3 P.M. had again fallen to 48.

April 14th: Digitalis discontinued; whiskey decreased; muriate ammonia, grs. v every two hours.

April 16th: Sleeps all night; coughs very little; eats with good appetite. All medication discontinued.

April 19th: Convalescent.

I have numerous histories and charts demonstrating an equally rapid influence upon the course of the disease and comfort of the patient. Croupous pneumonia in children is not a very fatal disease, but among the poor classes, which furnish the patients at the asylum, it was far more fatal than before the bath treatment was adopted.

We have large clinical confirmation of the value of hydrotherapy from sources which cannot be doubted.

A scientific clinical demonstration of the general wet pack in pneumonia is furnished from Kussmaul's clinic (Berl. klin. Wochenschr., 1888). Sheets were dipped with water of 68°, and in these the body

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was entirely wrapped, except the arms, and covered with a blanket and rubber sheet. The patient remained a quarter of an hour, or longer, if he felt comfortable. Decrepit and old patients were not thus treated. The patients, almost without exception, felt comfortable, dyspnœa was diminished, and sleep was induced, although the temperature was reduced only a few tenth degrees. A thorough derivation to the skin was the chief aim in view. It will be noted that Kussmaul has here confirmed by valuable clinical observations the theoretical conditions aimed at by Dr. A. H. Smith, to which reference will be made later.

Dr. Fenwick, of the London Hospital, has given to the Lancet an analysis of 1,000 cases of pneumonia seen in that institution during the last ten years. Cases admitted shortly before death took place, or twenty-four hours before a critical turn in the disease, are omitted from this report. In the sthenic cases, which numbered five hundred, the treatment was generally along the three general courses described as follows:

First: Treatment by means of hot applications to the chest, in conjunction with remedies having tonic and expectorant properties. The mortality in this class of cases exceeded 20 per cent.

Second: Cases in which the only treatment was by quinine in large doses. The mortality here exceeded 20 per cent.

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Third: Cases where the treatment was by various antipyretic measures. In twenty-six of these cold applications to the chest were employed, with a mortality of 15 per cent.

The cold pack was tried in an equal number of cases, with about the same mortality. Cold sponging, used in fifty-six cases, had a mortality of 13 per cent. The "ice cradle" was used in forty-three cases; mortality only 7 per cent. By all the various cold applications 108 cases were treated, with 10 per cent. of failure. By all other grouped phases of treatment, the losses were double those by the cold method. Stimulants were given in these latter cases whenever indicated. Cold appears to be the best of the antipyretics for the class of patients with which Dr. Fenwick has to deal, chiefly for the reason that it has less of depressant action upon the heart than antipyrin, quinine, etc. In the earlier stages of the disease the true treatment involves a reduction of the temperature without cardiac depression. In the later stages the pulse is the great guide for treatment in the matter of strengthening the recuperative forces by means of stimulants. In many cases, camphor, digitalis, and alcohol will not be needed, but in impending cardiac failure these agents become vastly important. The period of crisis, also, is attended with especial dangers referable to cardiac incapacity, and it is necessary to be watchful and guard the patient, at this stage, by means of alcoholic and other suitable forms of stimulation.

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The aim of the author being a perfectly fair representation of the subject, this contribution from a well-known clinician will prove valuable in molding opinion.

RATIONALE.

If a therapeutic measure may be explained upon rational principles, the empirical results obtained from it are at once confirmed. It is a conceded fact that in pneumonia the right heart is working at great disadvantage, because it is driving blood through obstructed vessels, also that an elevated temperature is crippling its nerve supply, which is already menaced by decreased oxygenation of blood. What remedy will fulfill all three of these indications, viz., reduce the temperature, tone up the heart, and refresh the dulled ganglia?

Clearly the cool bath meets these indications. Jürgensen has been very successful with the *cold* bath, but, as this seems to be a heroic measure, we may be reassured by a logical rationale of its action. The *cool* bath not only meets the above-stated imperative demands of the tottering organism, but it fulfills also the indication first clearly brought out by Dr. Andrew H. Smith, the widening of the peripheral blood-stream. This is indeed the key which explains the clinical fact referred to by Jürgensen (but erroneously explained by temperature influence alone), that when the crisis occurs suddenly, as it usually does in pneumonia, the dyspnœa and heart weariness

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disappear at once, although the local inflammatory obstructions are still present at that moment. The explanation of this remarkable phenomenon is to be found in the fact that the sudden fall of temperature in the crisis of pneumonia is always accompanied by a relaxed condition of the cutaneous vessels, often manifested by colliquative sweating. This increased area furnished to the circulating blood relieves the right heart at once; the dam is cut, as it were, and the surging stream of blood that was burdening the the right heart has spread out at a time when the natural powers are also coming to the rescue in beginning resolution of the infiltrated lungs. Dr. Smith would have us imitate this method of relief by medicinal agents. No medicine will dilate the arteries and promote transference of blood to them from the veins, for any length of time. "Artificial respiration and ligaturing the extremities to prevent return of flow" can only act temporarily. The cool bath comes to our rescue here. Anyone who has observed how the surface of a patient with high temperature reddens under friction in a bath will at once appreciate that this is a physiological method of dilating the peripheral vessels, and, what is better, restoring the tone upon which a large part of the circulation depends. Moreover, the pulse is always slowed by it; the respiration is deepened and slowed also. We have, therefore, every indication in the treatment of pneumonia fully met by the properly adapted bath, viz.:

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1. To reduce the temperature.
2. To tone up the action of the heart.
3. To refresh the failing nerve supply of the heart and lungs.
4. To deepen the respiration.
5. To enlarge the surface of the blood.
6. To restore the lost tone of the capillaries.

Thus we have a physiological weapon against pneumonia, which has proved itself of marvelous power at the bed-side, as is testified by the personal observations of the writer, and by the conclusions reached by Prof. Penzoldt (Münch. med. Wochenschr., 1890, No. 36). In a careful analysis of 2,200 cases treated from 1867 to 1889 in the Poliklinik of Erlangen, he says: "The results show that antipyretics do no real damage in pneumonia, but that, carefully applied, they are useful. The reduction of temperature is not to be regarded the sole factor. If the indication is to improve the respiration, circulation, and cerebral activity, and to further expectoration, preference should always be given to a cautious bath-treatment. If the latter is not possible, or if, besides, a calming effect upon the subjective condition of the patient is desirable, a cautious use of the modern antipyretics is permissible."

Fismer (Archiv. f. klin. Med., 1873, p. 443) gives, as comparative results in 220 cases treated with baths and the same number without baths at Basel, a reduction of mortality of 9.6 per cent., although the former were more severe cases.

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Prof. Baginsky, of Berlin, reports (Archiv f. Kindeheilk., B. 13, 1891) thirty cases of croupous pneumonia in children, characterized by high fever up to 106°. Twenty-four were entirely cured, two were convalescing, and four, suffering from complications (pleuritis, tuberculosis), were improving. Baginsky prefers a mild and careful antipyresis, together with tonics and stimulants, and regards cold water as less likely to produce the dangerous effects of chemical agents. He justly claims that, as the nervous system of the child is more impressionable, low temperatures should be avoided, especially as its cutaneous surface is more extensive and the surface vessels more abundant in proportion than in the adult. Cold baths, from 86° to 76°, are useful, but the cold pack is to be preferred. It is more convenient, it disturbs and alarms less, and has a vivifying effect upon the nervous system, while its effect in proper cases is undoubted. Baginsky applies the packs by wrapping the entire body except the face in sheets wrung more or less out of water from 58°–72° and covering with a blanket. In ten minutes these are repeated; and again once or twice later; the child may remain in the last (see p. 31). These packs may be repeated two or three times a day and preceded by stimulants. If they do not reduce the temperature considerably, the prognosis may be regarded as more serious. Baginsky does not resort to cold applications except when the temperature is very high, or nervous or adynamic·

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symptoms are manifested with moderately high temperatures. He occasionally administers medicinal antipyretics in conjunction in protracted cases of pneumonia, just as he does in other febrile diseases.

This recent confirmation of the value of hydriatic measures in this disease is valuable, coming from one of the foremost pædiatric authorities of the day.

It is needless to multiply clinical testimony, when the *rationale* of the bath-treatment is in accord with accepted views. When the baths are insurmountably inconvenient to patient and attendants, it is my custom to alternate them with medicinal antipyretics, carefully preceded by stimulants. Especially if the pulse is rapid and feeble, the baths should be preferred; they should be of shorter duration and more frequently applied.

THE ERUPTIVE FEVERS.

These, for the sake of brevity, are grouped together.

The method of applying hydriatic measures differs according to the stage of the disease and condition of the patient. Unless the temperature is above 104°, no bath under 85° should be used. If the patient is restless, a tepid bath is extremely useful, especially if it can be prolonged for half an hour, without exciting the patient too much. When, in the beginning of the disease, there is a rapid rising temperature, with mottled skin, or a tardy appearance of

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the eruption, with a rapid pulse, cyanotic nails, or convulsions, there is no measure that affords such positive relief to the nervous system which is overcome by the toxæmia as a cold affusion or dip bath. Held naked in a tub containing twelve or fifteen inches of water at 100°, several buckets or pitchers of water at 75° to 80° are thrown over the head and shoulders; the body is then well rubbed and patient put to bed. The result is usually at once apparent in an improvement of all symptoms. As the relief may be of short duration, the treatment should be repeated every two or three hours, if necessary. The *rationale* of this treatment is explained on page 12.

When the temperature is high, pulse rapid, and pulmonary complications are threatening, we have in the graduated bath, 90° to 70°, for 10 to 15 minutes, with friction, an invaluable remedy which, once judiciously tried, will give the attendant and friends sufficient confidence to overcome the invariable objections of the patient. It should be repeated every three hours, if the temperature indicates it. The bath may be of shorter duration and repeated more frequently. The rule is, in case of collapse, adynamic, or nervous symptoms, to use cold affusions or a dip (not over 70° F.) quickly applied; for high temperatures, etc., longer baths at 70° to 90°, with gentle friction or the wet pack.

The following account of Dr. Reimer is the result of so large an experience that it is here cited in

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full from the Archives of Pædiatrics, 1890. Basing his statements upon a large number of thermometric tracings, Reimer divides scarlatina into the following forms:

	Per cent. of mortality.
1. Simple or uncomplicated scarlatina.	
a. Mild	0.0
b. Severe	83.76
2. Complicated.	
a. Short, mild	2.08
b. Short, severe	6.94
c. Long-benign	5.66
d. Malignant	39.34
e. Prolonged, benign	26.47
f. Malignant	79.99
3. Scarlatina following other diseases	81.96
4. Scarlatina followed by other diseases	44.32

In the treatment of 3,460 cases of the disease, 978 were subjected to hydrotherapy, which was used with the idea of reducing the temperature in the following forms: (1) Cold compresses; (2) cold envelopment; (3) cold envelopment with dry friction; (4) cold affusions of water in the empty tub; (5) cold affusions in a half-bath progressively cooled; (6) short or long tepid baths; (7) full baths, gradually cooled; (8) cold half and full baths with friction. Cold compresses upon the head, thorax, and abdomen were frequently used, except in cases in which the restlessness of the patient was so great as to make its use too difficult. Their action was favorable upon the heart, but they

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did not lower the temperature to any great extent. Cold envelopment was used, especially in nervous, anæmic, or rachitic children. There was a favorable action upon the heart, but hardly any effect upon the temperature. Cold envelopment, combined with dry friction, was used in cases in which it was desired to produce cutaneous revulsion and excite the nervous system. Under their influence the respiratory movements became more regular, but the temperature showed no change. Cold envelopment, combined with affusions of water in the empty tub, the temperature of the water being 54° to 57° F., was tried in cases of cyanosis, stupor, and collapse. This treatment, used with all proper precautions, generally gave good results, but there was no effect upon the temperature. Results quite as favorable were obtained with cold envelopment, followed by affusions in a gradually cooled bath. In some of these cases the phenomena of collapse were notably aggravated, hence this method calls for unusual precaution in its use. The effect of prolonged tepid baths was bad. The temperature was uninfluenced, and a general weakness resulted, which in some cases was of a threatening character. The same was true in all cases in which a gradually cooled bath was used. Such baths have a sedative effect in typhoid fever, but in scarlatina their effect is pernicious. The efficiency of full cold baths in scarlatina was undoubted, if they were used methodically and with

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proper precautions. The patient is plunged into a tub half-filled with water at a temperature of 54° to 57° F. After removing him from the water, he must be rubbed briskly and then wrapped in a woolen blanket. In such cases the temperature will frequently drop several degrees. The patients seem much relieved by such bathing, and will desire its repetition. It is impossible to give general rules for the use of hydrotherapy in scarlatina; the indications will vary with the progress of the disease. With regard to the treatment of the disease by the use of antithermic remedies internally, the author did not obtain favorable results with quinine, salicylate of soda, kairin, thallin, etc. On the other hand, the antithermic action of antipyrin never failed, but its use should be attended with the greatest care or account of the danger of collapse.

Dr. Hiram Corson, of Pennsylvania, a practitioner of high standing, furnishes, in the Journal of Balneology for March, 1892, some clinical testimony on the use of cold in eruptive fevers. He concludes thus:

"Rarely has anyone made a more careful trial of any remedy than I have made of this, in a practice of fifty-nine years, under the daily watch of intelligent physicians, anxious, no doubt, for my success, but doubtful of the propriety of my practice, and too timid to resort to measures to them so heroic.

"And now, in closing my career as a practitioner, and looking back on the countless fights had with

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death in hovel and in palace, I can truthfully declare that no means ever used by me, or which have ever been known to me as used by others, in scarlet fever, have so successfully warded off its blows and shielded patients from harm and restored them to health as the use of cold water and ice."

In the same number Dr. Fodor, of Vienna, states that hydrotherapy is superior to all other methods of treating measles. He recommends washing of the entire body with cool water; this is done in bed by placing a waterproof sheet under the patient. The result is a slight reduction of bodily temperature, and stimulation of the heart action, nervous system, and digestive organs.

Dr. Alexander Goldstein reports, from the Buda-Pesth epidemic in 1891, 231 cases of *scarlatina*, in which cold baths were chiefly used. He says: "Antipyretics were avoided, because innumerable cases have convinced us that the seriousness of the disease does not lie in the high fever, although it cannot be denied that its prolonged continuance damages the heart, as well as the nervous system. Something must be done, therefore, to arrest it. Chemical antipyretics acted badly on the system outside of temperature reduction; cold and cool baths, on the contrary, whose happy effect we had learned to appreciate in last year's epidemic, acted excellently in this scarlatina epidemic. A tub, half-filled with water at 86°–104°, was placed alongside the bed, and the patient rubbed in it

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for two or three minutes. He received about one-half to one ounce cognac, and the water was cooled down to 71°–82° F. by pieces of ice, which, being moved back and forth, threw waves upon the chest and back of the patient. The good effect was not only in the lowering of the temperature, but also in improving the respiration, innervation, and cutaneous action. The patient, who was unconscious before the bath, became less apathetic, etc."

SMALL-POX.

Hebra's treatment of this disease by prolonged tepid baths is valuable (Intern. klin. Rundschau, No. 89, 1890). Not only may disfigurement be prevented by baths, but also the danger from purulent absorption be diminished. The greater the eruption and the higher the fever, the longer you must leave him in the water. These prolonged baths remove pus, macerate the vesicles, and further suppuration. Our best effort is toward removing the pus, and the best method for softening the pustules is to macerate them by prolonged baths, which open them also. If the case is severe, a continuous bath is needed, in which the pustules might be readily opened with scissors. After a bath of one or two hours, the patient should be moved and powdered with 10 grains of salicylic acid and 50 parts each of talcum and starch. He should then be wrapped in wet linen cloths and covered with blankets. The powder is washed off with green soap in the next bath.

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In the ordinary type of the malady we have in the pure salicylic acid the most valuable remedy. In the author's experience the local as well as general effect of this remedy is greatly enhanced by compresses wrung not quite out of water at 50° to 60°, wrapped around the painful parts and covered with flannel. It is those dangerous cases, however, regarded as *rheumatic hyperpyrexia*, in which more energetic treatment is indicated. Whenever the temperature rises above 105°, despite the salicylate treatment, the brain is threatened and danger is imminent. Ten years ago a committee of the Clinical Society of London made an exhaustive inquiry into this subject (see paper by Dr. H. C. Male, Practitioner, 1891), and in their report they show the necessity of not allowing the temperature to exceed 105°. Thus, in six out of eleven cases (unbathed) the temperature did not reach 106°, and they have shown that the treatment by cold is more successful the earlier it is commenced. Moreover, the temperature may rapidly rise when once it begins. In a case mentioned by Fox, the temperature ran up from the ordinary to 109° in two hours.

There are practically two methods of applying cold, says Dr. Male. The patient is lowered in a sheet into water of 90° to 100° F., cooled down by adding cold water, or preferably pieces of ice, till it is reduced to 60° or 70°. He should remain in the bath

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till the thermometer, placed in the rectum, has fallen to 101° to 102°, unless faintness occurs.

The cold pack is applied in the following way: The patient remains in bed. He is stripped of all clothing, and a mackintosh placed under him. Towels are wrung out of iced water and applied to the trunk, head, and limbs. These are changed frequently, and the body sponged over with lumps of ice. An ice-bag should also be applied along the whole length of the spine. The temperature must be carefully watched as before, and the pack discontinued when the reduction has been effected.

Wilson Fox collected a series of twenty-two cases from 1867 to 1871, temperature ranging between 106° and 111.7°. Eighteen were treated by ordinary means, without the application of cold, and all were fatal. The remaining four were treated by the cold bath, and three of them were successful, the highest temperature being 110°.

The committee of the Clinical Society of London collected a series of sixty-seven cases during the ten years ending 1879. In thirty-nine of these the temperature exceeded 106°, and in thirty-four the treatment by cold bathing was adopted and fourteen recovered, the highest temperature being 109° to 110°. Of the more moderate temperatures among these (viz., between 106° and 107°), eight out of eleven cases recovered—over two-thirds. All the cases that were unbathed died.

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In the ten years ending 1890 many cases of recovery have been reported from time to time in the journals. Dr. Male has been able to find a record of sixteen cases with thirteen recoveries, temperatures ranging from 106° to 110.4°. The pack was used in eight of these, with two deaths, and the bath in the remaining eight, with one death. There is, therefore, ample evidence of frequent recovery after extreme temperatures, which under other conditions must certainly have been fatal. While, however, recognizing the success that often follows the employment of cold in rheumatic pyrexia, we must ascertain if there are any dangers attending its use.

Bristowe records a case where the cold bath on two occasions produced such serious faintness after five minutes' immersion that it had to be discontinued. At Guy's Hospital, from 1874 to 1877, death took place on two occasions during immersion; but in these cases the bath was probably too long delayed, and the heart and tissues had suffered too much from the excessive heat to withstand the shock. In several cases violent purging has resulted after immersion.

The following case is reported by Dr. H. C. Male: A. H., age 32; had been ill with rheumatic fever for six weeks, when he became delirious, flushed, and wild-looking; partly conscious, with high pulse and rapid breathing; temperature, 110° in axilla. As is usual in such circumstances, pain and swelling had left his joints, and he could move freely in bed.

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Sweating had entirely ceased. He was at once put into a sheet wrung out of iced water, and his body was well rubbed over with ice. During the first ten minutes his temperature rose to 107.6° (rectum). In half an hour it fell to 103°, and the pack was discontinued, as it caused discomfort. He was rubbed dry and lightly covered with blankets. Patient now seemed quite himself. Delirium had ceased, and his condition in every way was improved. Quinine, 5 grains, was given every hour (larger doses were vomited).

During the afternoon temperature again rose above 104°. Pack was repeated, and temperature reduced to 101°, with immediate relief of symptoms (duration of pack not recorded). The patient died November 4. There is little doubt the patient's life was lengthened for some days.

IMPROPER METHODS.

This case is interesting as showing the powerful effect of hydriatic measures, and illustrating an improper method of applying it. To place a patient into a sheet wrung out of ice-water, and to rub the body well with ice, will appear to the reader who has carefully studied the *rationale* of cold bathing in these pages as contrary to physiological ideas. The principal vessels were contracted, the blood was driven to the interior of the body, and "shivering and discomfort" were thus produced. If the sheet baths had

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been adopted, as described in these pages, with friction to dilate the peripheral vessels and enable them to carry the cooled blood to the brain, the effect would have been different. It may be claimed that the reduction of temperature testifies to the efficiency of the method. As the temperature was taken in the axilla, this was an utterly fallacious test, as I have shown.

The author has recorded a case of hyperpyrexia in rheumatism in the transactions of the South Carolina Medical Association for 1873, in which a temperature of 106° was reduced by the cold bath and ice to the joints. This record testifies to the length of time he has devoted to the clinical application and study of the remedial use of water.

Reference to previous procedures show the error many well-intentioned physicians fall into in the use of water. It has been there shown that ice-water is not an antithermic application. Indeed, the prolonged tepid bath is really the most efficient antithermic bath known. In a case of hyperpyrexia the latter would be more applicable than in cases of severe adynamia, in which iced water is more useful.

CHRONIC GOUT AND RHEUMATISM.

We have in these diseases the manifestations of a vicious mode of life or of exposure to other deleterious influences, combined or not with inherited tendencies, which but too often play an important rôle in ætiology. We must address our treatment in both to

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improving the digestion and assimilation of food, increasing elimination of effete products, and, by supporting the strength, enhancing the patient's powers of resistance. The utter futility of medicinal treatment for these purposes is evidenced by the multiplicity of remedies which have accumulated in our books upon the subject. To accomplish any valuable result in such a malady, to rearrange, as it were, the entire nutritive system, to divert it from its vicious tendencies, to remove products of retrograde tissue metamorphosis and to prevent their reproduction, experience has shown may best be done by physiological agencies, as diet, exercise, and certain hydriatic measures.

It is my custom to give these patients a diet containing the smallest possible quantity of nitrogenous material. Red meats are forbidden; also the white of eggs, fermented liquors—indeed all foods or drinks which tend to increase the production of urea and uric acid. So long as the best clinicians are unable to agree upon the true pathology of these diseases and the best diet for them, a nutritious, medium diet, like the above, has seemed to me to be the most valuable.

As Prof. Semmola has shown, there is no method of treatment which has given such remarkable results in these disturbances of tissue change as judicious diet and exercise, combined with hydrotherapy. Massage in the more painful stages and passive exercise in the subacute conditions are indicated. Most observers are agreed upon this point. When the muscles

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are placed in action, the lymph and blood-vessels are compelled to do their work, absorption takes place, and the general activity of the system thus evolved must aid materially in the removal of fluid deposits. The judicious prescription and equally judicious observance of gentle muscular exercise form an important element in the treatment of gout and rheumatism. It must be avoided as long as redness and local swelling are combined with pain.

A powerful auxiliary to judicious diet and exercise may be found in the application of certain hydriatic procedures. It will be found useful to distinguish, in this connection, between the several types of gout and rheumatism which come under observation.

1. The anæmic type, rendered so by long continuance of the disease and consequent abstention from exercise, by loss of sleep, etc.

2. The plethoric form, usually, though not altogether, found among the better situated.

3. The intermediate form between these.

In the first type, a tonic procedure being indicated, we have in the gentle and judicious application of cold water our most valuable remedy. The skin should be educated, as was described in the treatment of phthisis, first by the dry pack and subsequent cold ablutions, then by the dripping sheet and rain bath. In the third (intermediate) type the same course may be pursued. In these cases we have in the wet pack

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(*i. e.*, patients are wrapped in sheets wrung out of cold water, and covered with blankets like a mummy, to be followed in an hour by the half-bath at 70° to 65°) a valuable means, not only of promoting tissue change, but of removing debility, improving the appetite, and building up the nerve tone.

The second type (plethoric), in which there is so much stiffness in joints and muscles, without general failure of health, is more difficult to manage. The resolvent method is the most useful. In these cases I have found the hot-air bath, followed by the douche, most applicable. And here let me say a word of warning against the indiscriminate use of the Turkish bath. Being applied by ignorant attendants, the patient is subjected to treatment which may do him much damage. What is luxury and comfort for the healthy is certainly not always best for the sick. The heating of the body in dry blankets for several hours, while the patient is made to partake freely of cold water (preferably alkaline), is a method by which Priessnitz has obtained remarkable, almost marvelous, results, as we are informed by reliable observers living to-day—for instance, Prof. Semmola, of Naples.

The box hot-air bath, followed by the cold bath, is, after educating the patient's skin, a most valuable measure. It has been demonstrated that, aside from the beneficent effect upon tissue metamorphosis in the gouty and rheumatic, the increased energy and power of resistance of the cutaneous

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nerves against atmospheric influences is not to be underestimated. Colds must become more rare, and these are not only often the chief causative factor, but, especially in rheumatism, they form by their frequent repetition the basis of the entire disadvantageous tissue change.

The following clinical history from Duval (p. 553) illustrates the value of methodical treatment, even in desperate cases. It is of the third type mentioned above:

Z., a Pole, 65 years old, well developed, of biliosanguine temperature, high color, was sent to me by my friend, Dr. Raciborski. Patient has suffered greatly from the political misfortunes of his country, having lost his fortunes, which completely changed his mode of life, so that he was compelled to work as an engineer. He was subject to frequent attacks of gout, for which he had all kinds of treatment. When, on December 12th, he applied to me, he presented nodosities on most of his fingers and metotarsophalangeal articulation. Every week he had grievous attacks, lasting two to four days. He had no heart trouble, and no loss of sleep or appetite. Morning and evening he had a rain bath of five seconds, followed by a jet douche of a minute, played all over the affected articulation. On the 16th he had a severe attack; he was placed in the hot-air box, with wet compresses on head and feet; and when the skin became warm he received several drinks of cold water

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every five to ten minutes. He perspired freely in 25 minutes, and was then placed into a rain-douche for fifteen seconds, followed by a jet douche as above. He was well rubbed with warm, dry cloths, and was now able to walk, which he had not been able to do in two years so soon after the attack. The douches were renewed every day, the hot-air bath every two days. The paroxysms returned, but with less severity. On the 24th one commenced which was completely aborted. Treatment was continued, but he had three more approaches to attacks in ten days. From January 15th he had the hot-air bath every day. He left on February 12th, after having been entirely well for over a month. We have seen him time and again since, but he has remained well.

CHRONIC RHEUMATISM.

The following histories are furnished from the Montefiore Home by Dr. Max Rosenthal, late Resident Physician:

Case 1.—B. V., 54 years old; eight or nine years ago suddenly developed swelling at the elbow, which was very painful; same night affected in the left knee; spread to left elbow and wrist, then to right knee and ankle and toes. He was transferred in ambulance to Bellevue Hospital. After five or six days returned, home. It took some weeks to obtain complete cure. After an interval of six months, the disease recurred and lasted about three weeks. He had repeated

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attacks at shorter intervals up to two years ago. For two years he had swellings, with pain and stiffness in feet, knees, fingers, and wrists. Went to Mt. Sinai Hospital for gout, and received medicated compresses; later received salicylic acid and potassium iodide. He learned to walk with crutches; received massage with pine-needle oil. The disease returned while in the hospital, where he remained three months; when he left he was able to move around on crutches. Could not attend to his work any more; took salicylic acid.

At the time of admission to the Home he complained of pain in the ankles on moving around. Toes and ankles were quite stiff, knees less so. Toes were extended; skin around both ankles cicatrized and mottled, of a dark-blue color. He walked with great difficulty on crutches. Treatment: Anti-rheumatic diet and wet compresses to swollen joints, changed hourly; hot general fomentations and general bath on alternate days.

December 1, 1889: Wet pack on alternate days —sod. salicyl., xv gr., t.i.d.; much better; walks around with greater ease.

December 11th: Developed acute laryngitis.

Jan. 31st: Feels much better; says he feels lighter.

Feb. 15th: Has had hot-air box and Scotch douches on knees and ankles, followed by rain bath at 70°. Improvement continues under this treatment.

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He now can walk for hours without crutches; pain entirely gone. His recovery was complete. A few days prior to his contemplated discharge from the Home he was attacked by peritonitis from a perforation in the appendix, to which he succumbed.

Case 2.—S. Z., 26 years; single; Austrian; waiter; admitted November 14, 1889.

Family history: Father died at 45, twenty-one years ago, of phthisis; mother is alive and well; five brothers and two sisters living.

Personal history: Sick six months; had measles and scarlatina as child; at 6 both legs run over; had typhoid fever about the same time; was a weakly, delicate child; at 14 had rheumatism with severe pains in the muscles, which were painful on movement; no fever; lasted about seven months; cured by baths. Went to work in a hardware store at 17. Was thereafter disturbed by headache, dyspepsia; occasional winter cough, with expectoration. Last absent for two years. Last July attacked by gonorrhœa; discharge slight; treated by copaiba and injections. Two weeks after commencement of urethral trouble noticed swelling at the root of toes of right foot, and painful right knee; employed the Russian bath as a curative measure. A week later, right ankle became painful and slightly swollen on its inner aspect. Directly after, attacked by a severe pain in the small of the back, with stiffness. Two weeks later, left elbow became quite painful, especially on pressure; would

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leave one foot and go to the other. Spent three days in August in the German Hospital. Went two weeks later to Mt. Sinai for twenty-four hours. Treated outside by some medicine which induced profuse sweating. At time of admission presented swelling of right ankle, especially marked upon its inner aspect; also swelling of the eminences of the big and little toes, the latter very painful on pressure. The other foot was about the same, but less marked. Knees very painful, especially on extension. Standing was more painful than walking; gait was stiff and much impaired. Appetite was poor; bowels rather constipated; urine was high-colored. Gonorrhœa had stopped four months before admission. Sleep was poor; was very anæmic and badly nourished; urine, 1.022.

Treatment: Anti-rheumatic diet; ferr. oxid. sacch., 3, t. i. d.; hot fomentations and pack and half-bath on alternate days; cold compress to feet daily, changed six-hourly.

After admission appetite improved materially; sleep poor; constipation continued. Rochelle salts, ℥ i, in hot water at 6.15 A. M., daily.

January 2, 1890: Patient is entirely cured of his rheumatism. Feels in excellent health; constipation relieved; sleep still imperfect. Advised to stay a little longer to assure permanence in the obtained result.

Discharged cured.

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These cases illustrate the value of a judicious, systematic hydrotherapy in the most unpromising cases. Such cases are usually sent to distant hot springs and other resorts, with more or less benefit. To subject a patient, crippled by his painful joints, to long journeys and great pecuniary outlays, when far more efficient treatment may be had at home, is surely reprehensible. I have treated two cases of chronic rheumatism with favorable results, after they had determined to spend the winter at the Hot Springs of Arkansas. That a visit to mineral spring resorts is often beneficial, chiefly by freedom from household or business care and hygienic advantages, cannot be denied, but its effect is so often problematical that other more simple and less expensive and troublesome measures should first be resorted to. Such measures we have ample warrant in affirming we possess in the use of water judiciously adapted to each case.

I might furnish numerous histories from private and hospital practice to sustain this assertion. But they are all very much alike. There is a history of long suffering, stiffness and impeded locomotion, and general hopelessness, due to the failure of a multiplicity of remedies from doctors of high and low degree. They have rarely had systematic, prolonged treatment of any kind. Water especially has been avoided. None of these cases should be regarded as hopeless until hydrotherapy and its auxiliaries have

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been *fairly* tried. While my personal experience and observations justify this positive assertion, I have intentionally omitted the recital of cases from private practice, preferring to illustrate by cases recorded in institutions, because one is more or less liable to be biased in the reporting of his own successful cases.

ANÆMIA AND CHLOROSIS.

Whether it be idiopathic or a manifestation of organic pathological processes, a faulty hæmatosis most frequently demands the attention of the physician. The patient and his friends are justly anxious when pallor, accompanied or not by emaciation, points with unerring finger to some serious defect in the system. The remedies usually applied with more or less energy are nutritious diet, exercise, change of scene, and iron. Months and years are sometimes spent, with more or less success, in the treatment of the failing hæmatosis. Of what avail are a nutritious diet and iron if the appetite is feeble and the stomach incapacitated? is a sad but frequent observation.

In mild cases of functional anæmia, due to overwork, inattention to sanitary conditions, insufficient food, or mental disturbance, the removal of the cause is the chief end of treatment. But these may be powerfully aided by certain hydriatic procedures, whose effect has been demonstrated to improve the force of the heart, deepen the respiration, and enhance tissue metabolism. That water of low tem-

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perature, rapidly and briefly applied under good atmospheric pressure, produces these effects, clinical observation has frequently demonstrated. In the able thesis of M. Thermes, read before the Société d'Hydrologie in 1878, he offered, as the result of careful examination with Hayem's hæmometer, the demonstration that the judicious application of cold to the periphery increased the number of red corpuscles and improved their quality. Winternitz states (Path. u. Hydrotherapie der Phthise, p. 26) that in numerous cases of chlorosis and anæmia he has demonstrated an improvement in the oxyhæmoglobin constituent of the blood by Fleischl's hæmometer.

The necessity of promoting and encouraging tissue change in all diseases in which there is a faulty hæmatosis is obvious. Here I am able to furnish abundant testimony of the auxiliary value of hydrotherapy. Again and again I have observed cases of anæmia and chlorosis, which had defied prolonged iron treatment under my own care as well as under the advice of colleagues, yield readily when a suitable hydriatic method was added.

The most simple means for this purpose is the cold ablution, taken every morning while still warm from bed (but not alternating with warm bathing), not with a wash-rag, however, but by pouring water at 70° abundantly from a sponge or pitcher upon successive parts of the patient, who stands in a little hot water to prevent chilling. Gradually we may advance to the dripping sheet and wet pack.

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Several years ago Dr. Mary Putman Jacobi wrote an able essay on the wet pack and massage in anæmia, in which she furnished so exhaustive a description of the method and physiological action of the treatment that I refer to the original for valuable data. Suffice it to state that *in no type of disease does the water treatment evince more brilliant effects than in anæmia and chlorosis.* The most valuable method in my hands has been the rain bath of 90°, reduced to 80°, and followed by the spray or jet douche of five to ten seconds at 50° to 70°, the temperature being lowered one degree every day.

That the presence of organic diseases does not preclude the application of hydrotherapy has been amply demonstrated by its effective application in cardiac, renal, hepatic, uterine, and nervous diseases. Whatever tends to elevate the general tone of the system, to stimulate the appetite, heighten the nutrition, give sleep, and refresh the system, is of value in cases of organic disease. We have ample warrant for asserting that the cautious application of water has no equal in these therapeutic qualities.

The effect of these procedures may be greatly enhanced by the hot-air bath of sufficient duration to fill the cutaneous vessels. An occasional hot-air bath, brought to the point of free perspiration, is of value in the promotion of tissue change. Indeed, Sholz, of Bremen, has reported some remarkable results from this feeble depletion of chlorotic patients, followed by tonic procedures.

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CHAPTER VIII.

PHTHISIS.

Phthisis is a disease in which we have a serious and destructive local manifestation due to a general infection. Realizing this fact, its most modern management has become exceedingly simple, and more successful in proportion to its simplicity. Methodical treatment under conditions which afford the patient the best opportunity for outdoor life, in air that is free from dust and other vicious elements, has proved in the hands of Dettweiler and Brehmer, and others, so efficacious that we may look forward to a much more hopeful prognosis in the future. *Phthisis has now become one of the curable diseases.*

The most important indication is to endow the system with power of resisting the inroads of the established disease and to treat complications and sequelæ. This may be met by residence in an appropriate climate, by proper and carefully regulated exercise, diet, and hygiene, by certain medicinal agents, and last, but not least, by a *judicious hydrotherapy.*

With regard to exercise, the plan adopted by Dettweiler and Brehmer of exposing patients to the constant influence of pure air and sunshine, without the possibility of chilling them, is the most useful, and may be accomplished in private practice also, as I shall show.

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The lungs should be treated as in every other inflamed organ. So long as active inflammation exists, they should be kept at rest, or slowly and gently expanded. The *presence of fever precludes outdoor exercise.* Simple outdoor life must then be substituted, with massage or passive movements to stimulate the muscular system. Much of the ill-effect of absolute quiescence will be counteracted by hydrotherapy, if properly applied.

In this measure we possess an agent whose power for good is incalculable, and which has given me more valuable assistance than all other means combined. The judicious application of cold or cool water to the periphery produces a stimulus to the sensory nerves which is transmitted to the central nervous system, and thus *refreshes every function dependent upon the latter.*

The respiration is gently but slowly deepened whenever the cold water impinges upon the skin. The heart is made to contract with more vigor when the peripheral circulation is improved by the shock, and consequent contraction and subsequent dilatation of the cutaneous capillaries take place. The appetite is improved, tissue change increases, and, if there is a rise of temperature, it is subdued mildly but surely.

Solkowsky reported in the Bulletin de Thérapie, for 1877, 106 cases of phthisis; 60 in the first stage, 29 marked, 17 advanced. After six months' treatment

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by the cold douche, 39 were cured, 34 improved, 19 improving, 7 without result.

The value of hydrotherapy in phthisis has been recognized by Brehmer, who even claimed to be the first one to apply it in this disease. Winternitz has shown that it must be an agent of decided tonic power, inasmuch as out of 2,400 guests at his institute in Kaltenleutgeben, which I have personally visited, 56 per cent. showed an increase of weight. *As nutrition is the chief aim in phthisis*, we possess in hydrotherapy a powerful weapon which, rightly used, will surely demonstrate its value.

But, aside from this important consideration, the predisposition to repeated colds and consequent probable aggravation of the local processes and general symptoms may be diminished by the neuro-vascular discipline to which the skin is daily subjected by appropriate baths. This hardening process has long been recommended for those predisposed to phthisis. Ziemssen speaks of it in his lectures on the treatment of tuberculosis as "*a remedy of extraordinary value* for persons who are predisposed to or have acquired phthisis."

The *technique* of the procedure in this disease varies with each case. Brief applications of low temperature, as by douche or rain bath, the wet-pack, or rapid ablutions, are followed by rapid reactions, and, if well borne, are exceedingly useful as tonics; while, on the contrary, in cases suffering from elevated tem-

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peratures and great debility, more gentle procedures and higher temperatures are required. I have myself seen damage done to these cases by too cold applications, which are better indicated in a febrile or mildly febrile condition. This is contrary to views usually entertained on the therapeutic action of cold baths. My observations at the Montefiore Home for Incurables, in which cases of the most forlorn type, so far as previous hygienic surroundings are concerned, are received, have led me to adopt the following course, because the skins of many of these poor people have long been strangers to cold water, or, indeed, water of any kind. After a thorough cleansing with a warm bath or soap ablution, a day is allowed to elapse. The patient is now wrapped snugly, quite naked, in a woolen blanket, so that his entire body is excluded from air; other blankets are piled over him; the windows are opened, and he is given a small glass of iced water every ten minutes. Having lain in this position an hour, a part of the body is exposed and bathed as follows: A basin of water at 75° is made ready, into which the attendant dips his right hand, covered by a mitten or glove of Turkish toweling. With the wet glove the face is well bathed. Now one arm is exposed and rapidly washed and rubbed, then dried and replaced under the blanket. Other parts are then successively treated. At the termination of this ablution the patient is rapidly rubbed all over with a coarse towel. This treatment is repeated

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daily, the temperature of the water being reduced two degrees on each occasion.

The next step is the dripping sheet (see page 21). This method requires great care and skillful application. Its success or failure depends upon ascertaining by previous treatment the reactive capacity of the patient.

The most useful hydriatic procedure in phthisis, however, is the rain bath (see page 70). Unfortunately, this "finely-divided douche" can only be administered in institutions. The water should have a fall of not less than forty feet. The temperature adapted to the average case of phthisis is 70°. It should be higher (90°) in the beginning, and gradually decreased. Its duration should be brief and not exceed a minute. The advantage over other baths lies in the pressure with which the water strikes the body, affording a kind of massage, which assists in producing reaction even in feeble individuals. But it should not be applied without previous training of the skin, as above described. The rain bath is an antipyretic of great value, if its temperature is not below 65° nor above 75°; it is a stimulant and tonic if between 60° and 70° F. The skin should become pink while under it, and the patient must not be chilled by it; at least, any coldness he may experience should disappear after he is dried. This, indeed, is a test of the efficiency of all hydriatic procedures. Decided chilliness, continuing after thorough drying and friction, is an

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evidence of improper selection of the temperature, duration, or method of the bath. These should be modified as indicated by their effects.

The hot-air box-bath offers an. excellent substitute for the more tedious dry-pack above described. It quickly brings the blood to the surface, and thus enhances reactive capacity of feeble patients. Care should be taken, however, that the patients do not perspire in the hot-air bath. I have seen this error prove serious by destroying the patient's reaction and enfeebling him.

The following cases, taken from the records of the Montefiore Home, by Dr. M. Rosenthal, the senior resident physician, may serve as an illustration of the clinical results of this treatment:

J. J., tailor, æt. 33, German; admitted February 2, 1890. Family history negative. Illness of one and one-half years' duration. Began with pulmonary hæmorrhage, followed by cough; spat blood two days, and felt better after it. Continued to cough until December, 1889, when he had a most severe hæmorrhage, became very weak, and was confined to bed.

Continues weak; cannot work; coughs a great deal; expectorates a little mucus, often mixed with blood. Complains of pains in back, tickling in larynx; appetite is good, bowels regular.

Physical signs: Dullness over right upper lobe, as far as first rib, posteriorly to border of scapula, slight dullness over left apex; uncertain and accentu-

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ated breathings, with prolonged expiration over right apex, feeble respiration over left. Temperature, normal; pulse, 84; respiration, 28.

February 18.—Weight, 135 pounds. Treatment, one-minim creasote pill, two t. i. d., with cod-liver oil, 3 ss. Rain bath at 65° for 30 seconds daily.

March 1.—Coughs only a little in the morning. Weight, 142½.

March 20.—In fair condition; quite a little cough in the morning. Weight, 149½.

April 25.—Weight, 161½.

May 5.—In the last few days appetite is not so good; otherwise feels very comfortable. Coughs sometimes in the morning; no expectoration. Weight, 160½.

Dr. Dessau examined patient to-day. He found very slight broncho-vesicular respiration in the left apex. Impaired resonance on percussion of the same, and very few mucous râles. On the left below the scapula very few subcrepitant râles, probably due to old pleuritic adhesions.

May 11.—Right apex, vesicular respiration and very slight impaired resonance, which is often found normally in right chest, so that practically we can find now only a very slight infiltration of left apex, with some old pleuritic adhesions. Weight, 161 (a gain of 26 pounds). Discharged at his own request. He has been at work since that time.

J. D., aged 36 years, ill two years and a half.

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Had hæmorrhage two years ago, since then night-sweats, cough, expectoration, and pain in left side. Has been treated twice at Mount Sinai Hospital for phthisis.

Physical signs: On admission, dullness over left apex, impaired breathing; pleuritic friction râles on right side along axillary space. Weight, 162½ pounds.

Treatment: General sustaining measures, with daily rain bath at 65° for thirty seconds; damp compresses to chest.

Result: Improvement of all symptoms, and gain of fourteen pounds and a half during ten weeks.

December 16, 1890.—He was subjected to tuberculin treatment until April 29, other treatment being suspended.

The patient now lost so much in weight and general appearance that I frequently felt misgivings as to the propriety of subjecting him to the experiment. The rain baths were resumed, and his general condition at once improved and appetite returned.

At the present time there is no cough, the least amount of expectoration, and but few pleuritic friction sounds over left apex. His weight is 178½ pounds. Dr. Hodenpyl, who kindly examined all sputa, reported: First examination, about 10 bacilli to the field; second examination, very few bacilli; third, fourth, and fifth examinations, no bacilli.

This patient may be regarded as recovered, judg-

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ing from physical signs, subjective symptoms, his general condition, and the absence of bacilli.

H. S., aged 31, admitted May 2, 1890. Family history negative; always well until May, 1889, when he had first pulmonary hæmorrhage; was confined to bed eight weeks with cough, night-sweats, and afternoon fevers. In September, 1889, and January, 1890, he had hæmorrhages, and went to Mount Sinai Hospital, whence he was discharged improved in seven weeks. He had cough, expectoration, and pain in the chest; no appetite when admitted.

Physical examination: Dullness over right third anteriorly and posteriorly; subcrepitant and friction râles; broncho-vesicular respiration, with prolonged expiration. On left side, prolonged expiration, with some friction sounds over left apex. Weight, 129¾ pounds.

August, 1890.—Sputum found to contain bacilli.

In September, 1880, he had a hæmorrhage. During this time he received rain baths, syrup of hypophosphites and creasote; at times cod-liver oil. Under this treatment he steadily improved, so that when he was subjected to tuberculin injections, on December 6, 1890, he weighed 146 pounds—a gain of 16¼ pounds in six months and a half—and no bacilli were found by Dr. Hodenpyl in his sputum.

There were still, however, dullness over right apex, broncho-vesicular respiration, and subcrepitant râles. His temperature was 99°. April 15, tuberculin injections discontinued.

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There being no tubercle bacilli in the sputum and no cough or expectoration, and the physiological signs being only a slight, jerky respiration, he was discharged as cured, April 29, weighing 149. He has therefore increased twenty pounds since his admission, and 3½ pounds since injections were begun, during the continuance of which he lost very considerably. He went to work at Bronxville, N. Y.

A. V., a nurse in the Montefiore Home, weighed, in summer of 1890, 138 pounds. She was constantly engaged in the wards, in which her mother was also a nurse. She began to lose flesh while at work; cough and expectoration were pronounced, and she had two small hæmorrhages.

Physical examination reveals impaired resonance over left apex, jerky, exaggerated respiration; fine, moist and pleuritic râles. Bacilli abundant in the sputum. Weight, 126 pounds on January 5, when she was subjected to tuberculin injections.

She received 21 injections, progressively increased. They were always followed by decided febrile reaction. The last injection of 45 milligrammes was administered on the first of April, and was followed by very slight reaction. During the entire treatment she had daily rain baths.

April 10.—Cough, expectoration, night-sweats, and physical signs have ceased, her weight increased to 132 pounds, and, no bacilli being found in the sputum, she was discharged at her own request as

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cured. She is now working as a private nurse, feeling perfectly well.

In these cases the effect of the tuberculin was either deleterious or negative, while that of the rain bath was excellent.

The following case is cited to illustrate the tonic effect of hydrotherapy in a desperate and advanced case of phthisis.

B. S., aged 18, architect, admitted November 19, 1890. Mother died of chronic phthisis. Has been ill since he had an attack of pneumonia two years ago, with night-sweats, troublesome cough, and loss of flesh.

Physical signs: Those of a cavity. Tympanitic dullness over the upper third of left lung anteriorly, cracked-pot sound, cavernous râles, tubercular breathing, signs of catarrh in right apex. Complains of palpitation greatly. Weight, 115 pounds. Bacilli numerous.

Treatment: Rain baths, 70° to 65°, 30 seconds; cod-liver oil and creasote.

December 16.—Up to that time his weight had increased eight pounds, although the physical signs were the same as on admission. Temperature normal. He was now subjected to tuberculin treatment, under which he increased (as an exception to the rule), on April 10, to 138 pounds. Cough does not trouble him now, and he expectorates very little. A few bacilli at every examination. Physical signs not so

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pronounced. Râles few, and there is evidence of contraction of cavity. The palpitations, which troubled him greatly, have disappeared.

Dr. Hodenpyl's report is interesting:

December 16.—One hundred tubercle-bacilli to each cover-glass.

March 1.—Two bacilli to field.

May 7.—His weight is 139 pounds. He has been receiving rain baths since the injections were stopped. *He looks well*, and may be regarded as markedly improved. *He was discharged on July 14, weighing 140 pounds, and looking the picture of health.*

A case from private practice illustrates the air and water treatment, which has given me such satisfactory results that I would commend it, despite the fact that it involves much trouble and demands much judgment:

Mr. H. M., aged 28, whose brother died of phthisis, was sent to Minnesota seven years ago by Dr. A. L. Loomis, with the diagnosis of incipient phthisis. He settled in St. Paul, married, and his health improved, so that he regarded himself as cured. Of late he had sweats and fever.

January 9, 1891.—I found infiltration in right apex as far as the second rib. The general signs indicated a more advanced lesion. His temperature ranged from 101° to 104°; his cough was incessant, accompanied uniformly by blood-stained expectoration, containing bacilli abundantly; his appetite was

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nearly gone; sleep unsatisfactory, and accompanied by exhausting sweats. Altogether he presented the picture of a rapidly advancing process, although there was no evidence of breaking up. The weather was extremely severe, snow being frequent. Being exhausted by the journey, he was allowed to rest a few days. The pure-air treatment was adopted. The patient was placed upon a steamer chair, wrapped in furs from head to foot, the face alone being exposed. All the windows except one in the immediate vicinity were opened. He remained in this position from one to four hours, daily increasing the time. The windows were closed at twelve, when he was taken to his bedroom, which had been in the meantime thoroughly aired and warmed just before his return. He now received hydriatic treatment, after which he had luncheon, and was again placed in his steamer chair on the parlor floor. The bedroom windows, having a southern exposure, were again left open until he returned. When he was snugly in his bed one window was left open from the top over night.

The remainder of the treatment consisted in an effort to endow the system with power to resist the inroads of the disease. He was gradually educated to bear water treatment during the first five days, as described. He then received the dripping-sheet at 70°, with affusions at 65°, reducing both two degrees every third day until the former was 64° and the latter was 58°. He had abundance of milk, which he

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formerly loathed, and his appetite improved—eggs, strong farinaceous broths, and mushes. On March 14 he had so far improved that he had registered a normal temperature for two weeks, even in the evening; he was entirely free from cough and expectoration, except early in the moring; there were no night-sweats, and he slept soundly. The physical signs had improved, so that it required a very careful auscultation to discover them. Bacilli continued to appear, but in diminished numbers. *He had attained his normal weight, gaining twelve pounds in flesh.* I did not resist the importunities of the patient to allow him to return to St. Paul, inasmuch as he insisted that he was now in far better condition (feeling quite well) than he was when Dr. Loomis sent him there seven years ago.

The second chapter in this case is equally interesting. A few days after his return he rode in an open cable-car in inclement weather, contracting a cold which brought him to bed. Imperfect water treatment which he obtained at home probably contributed to this issue. Reports reached me that he was desperately ill, his physicians declaring it was useless to treat him any longer. Feeling that hydrotherapy had rescued him from desperate straits before, he determined to make the journey to New York. He arrived the latter part of April in a most forlorn condition. Examination revealed a catarrhal pneumonia, involving the entire lower half of the left

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lung, with evidences of softening anteriorly just under the nipple. His temperature ranged from 102° to 105°; he had night-sweats, severe cough and expectoration; no appetite. Nevertheless I subjected him to the same course as in the first instance—without any result, however. Wet-packs, too, failed to reduce his fever. He now entered the Montefiore Home for the purpose of more systematic treatment. Here the rain baths always reduced his temperature; otherwise he did not improve. He then was treated at home by my private nurse, but steadily failed. As a last resort, regarding the treatment at home as imperfect in some way, I had him brought to Long Branch, in order to have him under my personal supervision. The night-sweats were now so exhausting that I gave him atropine, without effect. He was again subjected here to a systematic water and air treatment. He was ordered to lie in a hammock under the trees all day; he had wet-packs and the dripping-sheet under my personal direction. Improvement was marked, showing itself first in a normal morning temperature and better appetite.

In three weeks he was so much better that he committed the imprudence of walking a mile to the Iron Pier to receive his wife. This act came near being fatal to him. The local process was again lighted up. He was put to bed; linen compresses wrung out of water at 65°, and later out of 50°, were wrapped around his chest and covered by a flannel

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bandage, renewed every hour, renewal being preceded by an ablution of the chest with water at 70°. He had a general ablution morning and evening. Under this treatment of absolute rest, and without any medicine except a creasote mixture, he again improved, with the exception of a brief relapse caused by another imprudence.

The patient was seen by Drs. Andrew H. Smith, Bermingham, and Offenbach at this time. To avoid the fall storms, he was sent to Dr. V. Ruck's Sanitarium in Asheville, N. C., in good condition. Here he held his own until he returned to St. Paul. In a letter dated March 16th he writes that he had gained 7½ lbs., had forgotten the meaning of night-sweats, appetite as good as ever; he has no fever, and coughs only a little in the morning. He is now (May, 1892) traveling for his house in Montana.

The cases here cited demonstrate the value of hydrotherapy in a disease in which formerly it would have been regarded as reprehensible, if not homicidal. It furnishes, therefore, a conspicuous illustration of the *use of water in modern medicine.*

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CHAPTER IX.

DISEASES OF THE NERVOUS SYSTEM.

The application of water in the treatment of functional and organic diseases of the nervous system has long been established. Especially since these affections have become more frequent by the wear and tear of modern life has its value been attested by physicians in all countries. Charcot and Erb are representatives of the highest type of specialists in this class of disease. The former's constant reference of cases to the hydrotherapeutic establishments, in Paris and elsewhere, is well known. Indeed, the douche treatment has come to be synonymous with Charcot's method. Prof. Erb has, in Ziemssen's Cyclopædia of Therapeutics, told us that "cool and cold baths in various forms belong to the most important therapeutically active agents in our field. Since this method has come to be more fully studied and more rationally applied, it has made notable progress. *Its results in all possible forms of chronic nerve troubles are extraordinarily favorable.*" This opinion from a man who has done so much for modern neurology must surely be an incentive to those who have never resorted to hydrotherapy to utilize it, and to those whose success has not been encouraging to investigate if there may not be some defect in their methods.

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As has been frequently demonstrated in these pages, success is absolutely dependent in all cases upon a correct application of the principles underlying the water-treatment. I have seen in the written directions given to a patient by an eminent neurologist the following: "Wrap yourself in a cold wet sheet every evening, and have yourself well rubbed with it." How can benefit be expected from such treatment? At the time these directions were written, the temperature of faucet water was 44°; at the present writing it is 60°; it will be 75° F. in the summer. Thus the patient would have a range of thirty degrees, and still be following the directions. A difference of thirty degrees, as every water nurse knows, produces an enormous difference of effect in the same patient. Moreover, if a patient requires a wet sheet of the temperature of 44°, its application at 75° would have a depressing effect. A gradual *decrease* of temperature would be far more rational. This incident is mentioned, however, to illustrate the looseness with which water is prescribed by otherwise well informed men, and to impress the lesson that failure is as sure to attend a careless hydriatic prescription as a careless medicinal one. This chapter shall for this reason be devoted to the specifications of those hydriatic methods which have been found most useful in practice, rather than a theoretical and laudatory exposition of hydrotherapy in nervous diseases.

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HYSTERIA.

This frequently obstinate and intractable malady has been the most fruitful field for hydrotherapy. In connection with other methods, such as isolation, diet, etc., the most valuable and unexpected results have been attained from water. In his "Clinical Lectures on Certain Nervous Diseases," translated by E. P. Hurd (G. S. Davis, 1888), Charcot says (p. 181): "In Paris for the last fifteen years hydrotherapeutic health institutes have treated such patients with complete success, possessing admirable arrangements for this end."

There exists a fallacy in the minds of many that, inasmuch as pouring cold water upon a poor girl who is writhing under a hysteric spasm or lies lifeless in a hysteric swoon often restores her, this heroic method may be indiscriminately applied to all cases of hysteria in and out of the paroxysmal stages. And some seem to picture Charcot's douches as the pouring of streams of cold water from a hose upon the trembling forms of these sufferers.

The real benefits to be derived from water in hysteria will be found in the assistance furnished by it in the building up the lost nerve tone, the improvement of appetite, digestion, and assimilation, and especially the resisting power of the nerve centres by transmission of the modifying effects from the peripheral nerves, which receive them from the impact of cold and cool water.

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In connection with water treatment, two types of hysteria must be distinguished, the *erethetic* and the *depressed*. In the erethetic types low temperatures and active mechanical procedures should be avoided. The wet pack, so ably described by Dr. Putnam Jacobi, is the most useful procedure. Enveloping the patient daily in a sheet wrung out of water not below 60° or above 70° (see pages 24–27 for technique), and allowing him or her to lie there, with open windows, for an hour or more, doubling the sheet if the procedure is prolonged, following this by a half-bath for ten minutes at 70°, or the rain bath for thirty-five seconds at 75°, under twenty pounds' pressure, is the most useful method. Once or twice a week the wet pack may be followed by a rain bath for ten seconds of lower temperature and higher pressure—say 90°, reduced quickly to 60°, under thirty pounds' pressure; and the jet douche, five seconds at 65° F.

The depressed types are benefited by daily cold affusions at home, while standing in warm water. The hot-air bath, to bring the cutaneous vessels into activity and fill them with blood, is an excellent preliminary measure in institutions. This is followed by the rain bath for thirty seconds at 85°, reduced gradually to 70° during the first few applications, and later to 60°. This may be followed by the spray douche for five seconds at 65° F., or the jet douche for three seconds at 65° to 55° F. The temperature may be lowered daily one degree until the lowest is 50° or less, if well borne,

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and the pressure may be increased two pounds every day until thirty pounds are reached. The patients should not be hastily dealt with; gentleness, combined with firmness, will bring success in this, as it does in all hydriatic practice.

In the reports of the Montefiore Home for 1890, a case of this type is referred to by Dr. Ettinger as follows: "Among those cured we wish to refer to a young girl who came to us with a complete palsy of the left arm and blindness of the left eye, of functional origin. For two years she sought relief everywhere without avail. She was then referred to us as a hopeless case, but it has been our good fortune to completely restore the power to her arm and vision to her eye, and to remove her immense depression of spirits. She is now supporting herself as a domestic. This is the type of a number of similar but less severe cases, where we have been equally fortunate. In all cases hydrotherapy has been the important therapeutic agent. In one case of severe hystero-epilepsy in a man, it has been the one agent to which improvement is due."

The following is a brief history of the last mentioned case, which Dr. Ettinger has kindly written for me lately: Judah Sharp; aged 58; Dutch; negative family history; gives history of convulsive seizures of twenty-five years' duration, often from ten to fifteen times a day. After admission he had from one to three seizures daily.

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Diagnosis: Hystero-epilepsy.

Treatment: Charcot douche daily, especially to spinal column, resulted in gradual diminution of convulsive attacks to complete cessation at the end of three months. After complete freedom for another three months he was discharged.

The following brief outline of a case, which is admirably detailed in all its scientific aspects by Dr. Boumeville in Progrès Médical for August 26, 1882, may also serve as a clear illustration of the capabilities of hydrotherapy in the most severe types of hysteria: "The father and grandfather of the patient were nervous and had migraine; the mother had convulsions and torticollis in infancy; one maternal aunt is an idiot; brothers and sisters died of convulsions; the patient had convulsions for nine months. An attack of hystero-epilepsy, which is admirably portrayed, occurred in February, 1880; then sensorial hemianæsthesia, zones hysterogènes, and aura. The convulsive attacks and contortions, re-occurring with great regularity, are fully described; they were followed by laughing and delirium. The treatment had consisted of tonics, bromide of camphor, baths, and gymnastic exercise. Cold douches, rain and jet, were now administered from thirty to forty seconds, from April 16 to May 3; a vigorous hydrotherapy was next pursued, once a day until the end of the year. In August the attacks became more rare and brief, and ceased entirely on December 13. During the first

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three months of 1882 the child showed great irascibility, and was subject to nervous laughter. The douches were resumed. On August 24, 1882, the child's condition was good, and there have been no new attacks." (Quoted by Duval.)

NEURASTHENIA.

The treatment in these cases is almost precisely like that detailed in hysteria, the aim being to endow the nervous system with power to resist the depreciating ætiological influences, whose removal is, of course, the *sine quâ non* of treatment. In no class of persons will more judgment be required in the selection of proper methods of the treatment. The types referred to in hysteria should be differentiated also in this disease. In domestic practice ordinary ablutions with water from 50° to 60° are very useful, the patient standing in warm water to prevent chilling.

There are two methods against which I desire to raise a voice of warning: (1) The indiscriminate use of the cold plunge for the neurasthenic has done much harm; (2) the practice of obtaining rapid alternations of heat and cold, by using warm and cold water in succession, is reprehensible. The application of warm water, as has been shown clearly in the chapter on the *rationale* of the action of water, produces a relaxation of the cutaneous vessels and tissues, and thus depreciates their tone and *diminishes their reactive capacity.*

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Reaction being the chief aim of treatment, because this is the stimulus for whose conveyance to the nerve centres we apply cold water, the object is to a certain extent defeated. Friction with warm cloths would be far more useful in domestic practice as a preparation for cold ablution. If the latter is applied immediately after rising, while the surface is still warm from the bed, the effect will be more pronounced. In institutional treatment the French method gives admirable results. The hot-air bath, not carried to perspiration, fills the cutaneous vessels without relaxing them, as I have daily opportunity of observing. If the patients, thus prepared, are brought under the rain bath or douche, a lower temperature is borne with comfort, and results in increasing reaction and consequent vivification; or a higher temperature, necessitated by the feebleness of the patient, may be used with better effect. The Scotch douche is also useful in cases with localized manifestations. Above all things, water must be regarded only as a potent auxiliary, not as a panacea for hysteria and neurasthenia.

CHOREA.

In this disease my personal experience with the water treatment has been so gratifying that I shall refrain from detailing it, lest I may be charged with undue enthusiasm. It is, however, as an auxiliary measure to medicinal, psychical, and hygienic treatment that water is chiefly useful, as is the case in

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other maladies. After failure with arsenic, iron, and other tonics, the simple addition of a mild hydrotherapy has served to emphasize the action of these remedies.

Domestic treatment is often sufficient in mild cases, but in those persistent types which are apt to become chronic and intractable, more active measures are required. Children affected with chorea bear low temperature well. The cold plunge, administered by a trained nurse, not by the mother, is useful; temperature, beginning at 90°, being daily reduced until 70° is reached, is useful.

Spinal douches, spray, jet, or fan, and the rain bath, at temperatures varying from 60° to 70°, of brief duration, not exceeding 30 seconds, are indicated if anæmia is pronounced. The fear of the little patient will readily be overcome by gentleness and higher temperatures in the beginning. It may be necessary for the nurse or mother to accompany the child into the douche room and accept a portion of the treatment at first. Only by gentle resistance and tact may success sometimes be achieved.

The following cases, cited by Duval, are of interest as showing the value of hydrotherapy in extreme cases even, and the methods of administration.

Acute Chorea.—The first is reported by Dr. Bergeron, of the St. Eugénie Hospital, in a boy 13 years old, who, after six months' convalescence from an attack of typhoid, was suddenly attacked with convul-

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sive movements of the right hand, which was thrown about violently, and he became delirious and incoherent, the body was congested and covered with perspiration. He became conscious on the morning after admission to the hospital. Diagnosis of acute chorea being made, the boy was subjected to a rain douche. The child, being very much afraid, was gently placed under the douche, which caused him to gasp and exclaim that he would be made sick. He remained one and a half minutes. After removal, the choreic movements ceased completely, except in the laryngeal muscles. These disappeared, so that he slept without any choreic movements. On the following day, there being slight movements and the child continuing to say "Na" frequently, he was again douched for one and a half minutes at 6 P. M. On the following day, the movements of the head being still noticed, another and last rain douche was given. A week later he was discharged cured (Méd. contemporanie, Jan. 15, 1865).

Chronic Chorea.—The following case of the most unpromising type affords a good illustration of this treatment:

J. F.; aged 21; seamstress; entered La Salpêtrière September 14, 1864; no hereditary history; medium height; nervous temperament and very excitable. Menstruation commenced at 14, and was irregular. Three years ago, frightened by the explosion of a boiler, she fell, uttering a cry, and was seized with several con-

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vulsions of short duration. Last year she became pregnant, and was satisfactorily delivered at l'Hôpital Necker. Two or three months afterward her character suddenly changed; she became irascible, choleric, wandering in her ideas, which even led her to contemplate suicide. Her appetite remained good, and all her functions were well performed. From no apparent cause, her left arm was seized several times by involuntary movements. Being a seamstress, she often pricked herself. Gradually these movements became more frequent, and even extended to the left leg. She now was frightened by someone jumping through her window, which greatly aggravated her case. The involuntary movements became incessant and extended to the right side, the face, and the eyes, which rolled in their sockets. The jaws opened and shut, and pointed convulsively to the right; on the right side the tongue was several times bitten, and the cheeks lacerated. Symptoms were more pronounced in the arms than in the legs, on the left than on the right side. During the night she enjoyed complete repose; no alteration of the sensibility. In this condition she entered l'Hôpital Saint Antoine, where she was treated with sulphurous and tonic baths. She left the hospital, improved, at the end of fourteen days.

She entered La Salpêtrière, September 14, in the following condition: Chorea very pronounced on the left side, severe movements on the right. She stood

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feebly, even with the aid of a cane; when made to stand on the left foot, she fell. The face was convulsed with movements, speech difficult, tongue not controllable. The heart presented all the indications of choreic heart; no mental trouble, excepting very rapid speech. On September 16 she was put under spinal-douche treatment. The jet was directed first on the most agitated parts, the left side of the body and the extremities, and finally up and down the spinal column until the skin reddened.

Sept. 17: Same treatment.

From the 18th improvement became marked. No more movements of right side, no more convulsions of face; only the left arm and left were agitated.

Sept. 22: All abnormal symptoms had disappeared, except that her voluntary movements were slightly quickened. When excited, the arms twitched slightly. On the 24th she had entirely recovered, even excitement produced no abnormal effect. Treatment continued. On October 5th she resumed her sewing, entirely recovered and her temper mild.

ORGANIC DISEASES OF THE NERVOUS SYSTEM.

The permanent bath, as detailed in the Berliner klinische Wochenschrift, July 18, 1887, has given such striking results that it demands notice.

L. Riess offers his experience in the Berliner Allgemeines Städtisches Krankenhaus, 1874–1886 (see page 62). The patient with compression myelitis

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died one year later from lung trouble. Autopsy revealed miliary tuberculosis, the remains of a spondilitis, cheesy peripachymeningitis, and compression and softening of the cord. And still the functional restoration of the cord was made possible in this case by baths.

In paraplegias of the lower extremities, paralysis of the bladder and intestines, etc., or in tabes, myelitis, and similar diseases in which bedsores compelled the resort to permanent baths, the sores not only healed, but the other symptoms improved and receded, if not too far advanced. These symptoms were: Local pains in the spinal column, excentric pains in the extremities, distressing contractures, reflex spasms, etc.

In chronic meningitis and apoplexies, brain tumors, etc., accompanied by hemiplegia and unilateral contractures, such baths have acted favorably. In general hyperæsthesiæ, cerebral excitement, delirium, etc., the calming effect upon peripheral irritations acts favorably on the main disease. Sleep is often induced in psychoses.

LOCOMOTOR ATAXIA.

Prof. Leyden, in his excellent summary of the therapeutics of tabes dorsalis (Realencyclopædia, Bd. 19), gives so clear and practical an account of the value and methods of bathing that I prefer to cite his teaching to giving my own views. After

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saying of internal medications that none of them have the slightest curative value, that the unprejudiced physician will advise them only in order not to cut off all hopes of improvement from the patient, he uses the following language on baths (p. 457):

"These belong to the most important therapeutic methods of tabes, and their correct and cautious therapeutic use is of the greatest significance. All sorts of baths have been lauded in the disease, and not without reason. It should be remembered, however, that they do not complete the cure, but produce a pleasant, calming, invigorating effect. We must be careful above all things not to do harm, especially with too frequent, too hot, or too strong mineral baths. Baths should be given with great care and comfort to avoid colds. Hence, patients should not be allowed to bathe much at home, especially in winter. It were better for them to be treated in institutions.

"The temperature should be according to the season and individuality of the patient—95° to 86°—and of 5 to 20 minutes' duration. The effect to be expected is in a general improvement and invigoration, especially a calming of the pain and an excitant, stimulant effect upon the sensory nerves. It may be regarded as probable that this mild excitation may exert a favorable influence upon the degenerative process, causing it to cease. Even if we do not ob-

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tain positive cures by this means, their beneficial effect cannot be questioned.

"The hot-air bath should be used only in the beginning, especially if the disease occurs after a cold. The same may be said of simple warm baths. The sool and carbonated baths are applicable in the later stage.

"Much judgment is required for proper selection of the cold baths. Although their careless use may easily do damage, their cautious use has proved decidedly useful and beneficial, especially in summer, as they act refreshingly upon the muscular debility and entire condition, preferably in not recent cases. Patients do not bear strong waves, low temperatures, or frequent bathing. The beneficial effects of cold baths are traceable to the general refreshment and invigoration, to the excitation of the cutaneous nerves, and the protective hardening against colds.

"Hydrotherapy is now applied in almost all institutions with so much judgment and moderation that patients may be safely sent to them. The baths should begin with water at 88° and be gradually lowered as far as 72° F.; they should not be forced, however, if the effects seem unfavorable."

My personal experience is entirely in accord with the views above detailed. Hoesslein's recent marked successes with the application of hot-air baths, followed by affusions (Münch. med. Wochenschr., 1891), confirmed by Ziemssen, who observed some of the

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cases, together with the testimony of Leyden and others, must lead to a more frequent resort to a cautious hydrotherapy in a disease in which medicinal agents have proved so impotent.

EPILEPSY.

In this disease the chief function of hydrotherapy is to counteract the debilitating effect of the bromide treatment. The daily cold ablution (60°–75°) and brief plunge bath, gradually lowered each day, have served me well in maintaining the patient's general health. The wet pack, followed by the half bath, has also proved useful in preventing the bromide acne.

SUBACUTE AND CHRONIC NEURALGIA AND MYALGIA.

When Romberg said that "pain is the prayer of the nerve for better blood," he expressed axiomatically the therapeutic value of water in most forms of neuralgia. The general invigoration of the nervous system, the improvement of the appetite, digestion, and assimilation are prime indications in the treatment of subacute and acute neuralgias. Locally, the Scotch douche is useful in sciatica and some cases of lumbago.

The hot-air bath to perspiration, applied every other day and followed by gradually lowered douches, is perhaps the most useful procedure. In anæmic and otherwise depreciated cases, the hot-air bath, fol-

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lowed by colder douches, or the wet pack referred to in hysteria as a tonic procedure, may be alternated with the first. Fleury reports some remarkable cases, one of which, although of thirty-nine years' duration, was cured by two months' hydriatic treatment.

The following case from Duval may illustrate its value and the method to be adopted:

Dr. Clark, the English physician, who enjoys a just reputation in Paris, sent me, on May 16, 1867, Mme. X., aged 34, who in January, 1867, suffered from an intense lumbago; ten months later the pains attacked the lower extremities. After various measures, among them a large blister, had been used without relief, hydrotherapy was advised. When I saw her, the left leg was flexed upon the thigh. Madame could not put the point of the foot to the ground, and two persons had to carry her into the douche room. The treatment was preluded by a general ablution of three minutes, with water at 78°. On the following day this was repeated, with water at 65°, immediately followed by a spray douche of two minutes, promenaded over the entire body, and especially over the left leg, with water at 52°.

On the 18th a rain douche, without prelude, was given one and a-half minutes, followed by a jet douche over the most painful part, with water at 52°. This treatment was continued until the 26th without sensible amendment; on the 28th the douches were preceded by the hot-air bath. The following day

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brought a favorable change; the patient could now support herself with the aid of the affected limb. Convalescence continued uninterrupted until July 28th, when she left us quite well. She returned, simply as a precautionary measure, for treatment from January till March, 1869.

My friend, Dr. R., was attacked five years ago, after a season of hard professional work, by a severe sciatica of the right leg, to which he applied all the usual remedies without avail, having the counsel of Dr. E. Seguin, and also being treated by Dr. Wilkie. Hot fomentations to the course of the nerve, followed by rapid ablution, relieved the pain. Hot-air baths to perspiration, followed by the plunge into water at 65°, daily, produced so decided an improvement that he was able to leave his bed in two weeks and go on a trip, from which he returned with renewed health and vigor.

In recent myalgias, those cases which are so often sent to Turkish bath establishments, the hot-air box bath, followed by gradually reduced douches, are far more efficient, because they are administered with more precision, and the physician is able to obtain the record of the patient's condition as a guide for future treatment.

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CHAPTER X.

SUMMARY OF CONCLUSIONS.

A careful perusal of the foregoing pages demonstrates that the *uses of water in modern medicine* are based upon the fact that it fulfils every condition demanded by a remedy which appeals for recognition by the profession.

1. Its mode of action may be explained in many instances upon rational, well-understood principles, being based upon experiments on animals and man whose accuracy does not admit of doubt.

2. Water is capable of more accurate "dosage" than medicinal agents, because (*a*) the range of temperature from 40° to 115° admits of every phase of stimulation or depression; (*b*) the range of atmospheric pressure from 0 to 30 or 40 lbs. admits of the same gradation; and (*c*) the duration from mere impact to the more prolonged application affords an immense range of effect. Thus we have in the thermometer, pressure-guage, and clock or sandglass three elements of precision in dosing the effects of water on the human body.

3. The clinical results, herein briefly detailed from the most trustworthy sources, entitle water to the highest appreciation of the profession, and justify the conclusions at the close of my article on Hydrotherapy in the American System of Therapeutics

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(Vol. I, p. 514), that hydrotherapy is an important and much neglected auxiliary in the treatment of disease. In many chronic diseases it has proved so successful after failure of medicinal agents that *no case should be yielded up as hopeless until hydrotherapy in some form has been tried.* My experience in the Montefiore Home, which receives only incurable cases, demonstrates the fact.

Domestic treatment by the methods indicated will suffice in most cases, but, if this fails, a methodical treatment by an expert hydrotherapeutist may be advantageous to the patient.

The most important elements are the thorough mastering of the general principles of hydrotherapy, precision in their application, and their perfect adaptation to the constitutional peculiarities of each case—*i.e.*, not treating the disease, but the patient.

For this reason the best consultants in Germany, Italy, and France—men like Leyden, Nothnagel, Binswanger, Senator, Ziemssen, Erb, Semmola, Dujardin-Beaumetz, and Charcot—send their patients to hydrotherapeutic institutions which are under the direction of educated physicians, who have studied the subject, with their diagnosis and general suggestions, rather than with specific directions for the method to be employed. So much depends upon the reactive capacity of each patient that only systematic observation can determine the most useful hydriatic procedure in each case.

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